SCIENTIFIC AMERICAN

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THE HIGH-LEVEL STREET RAILWAYS OF NEW YORK.

When the elevated railways, now in progress of construction in this city, are completed, four great iron bridges, with numerous branches, will run lengthwise Manhattan Island. Perhaps in the future, after people become habituated to trains thundering over them, to thoroughfares blocked with great iron columns, to the impartial distribution of ashes, oil, and sparks upon the heads of pedestrians and on awnings (a couple of the latter were set on fire this way the other day), to the diffusion of dirt into upper windows, to the increased danger of life from runaway horses and the breaking of vehicles against the iron columns, to the darkening of lower stories and shading of the streets so that the same are kept damp long after wet weather has ceased, and to the numerous other accidents and annoyances inherent to this mode of transit, more such bridges will be erected, and we shall have two storied streets. Doubtless shops will be made in second stories on the lofty railway lines, with bridge connections, after the manner which a large fancy-goods dealer on Sixth avenue is already taking measures to put in practice. The business population on some thoroughfares will be troglodytes—dwellers in dark and shaded caverns—and the other portion will be aerial. There will thus be a differentiation, so to speak, the probable results of which students of evolution might profitably, perhaps, speculate over.

When the four bridges are finished they will aggregate in length about between sixty and seventy miles, and there will be two on each side of the city. On the east side the New York Elevated Road runs a double track from Whitehall through Front and Pearl streets, Bowery, and Third avenue to the end of the island, at Harlem. The Gilbert Road has a circuitous route from Bowling Green to Second avenue, and along the latter street to Harlem, where it traverses the island over to Eighth avenue. On the west side the last mentioned line extends along Eighth, has its longest stretches on Ninth and Sixth avenues, and finally reaches Bowling Green by way of South Fifth avenue, West Broadway, and some of the smaller streets. The New York Elevated Road, on the west side, extends chiefly along Ninth avenue and has its lower terminus at the Battery. Two views of this last mentioned portion of the line are given on page 370. Fig. 3 shows the sweep of the structure as it traverses the Battery Park, and Fig. 5 represents the station as seen through the ferry gates at South ferry. In Fig. 4 is given a section showing the construction of this road along Third avenue, and by comparing this with Fig. 2, on this page, the reader will perceive the essential differences between the two plans. Fig. 2 represents the portion of the Gilbert road on West Broadway near Canal street, where, as is the case along most of its route, it spans the street car tracks. The Third avenue structure is much the more graceful, the tracks being directly supported on light lattice work pillars, and not on girders between the supports, as on the Gilbert road. The pillars are braced and connected by a simple arch. This plan, although it is fully as obstructive to the street as the other, is the least objectionable, as it does not materially shade the roadway below. The station at 23d street and Sixth avenue, on the Gilbert Road, is represented in Fig. 1. The buildings are now in process of erection, and will be quite tasteful in design, but the extensive area covered by them results in their materially cutting off the light and air from the thoroughfare beneath. Work is now being rapidly prosecuted both by day and night on the Gilbert line, and it is expected that regular traffic will be begun in a few days.

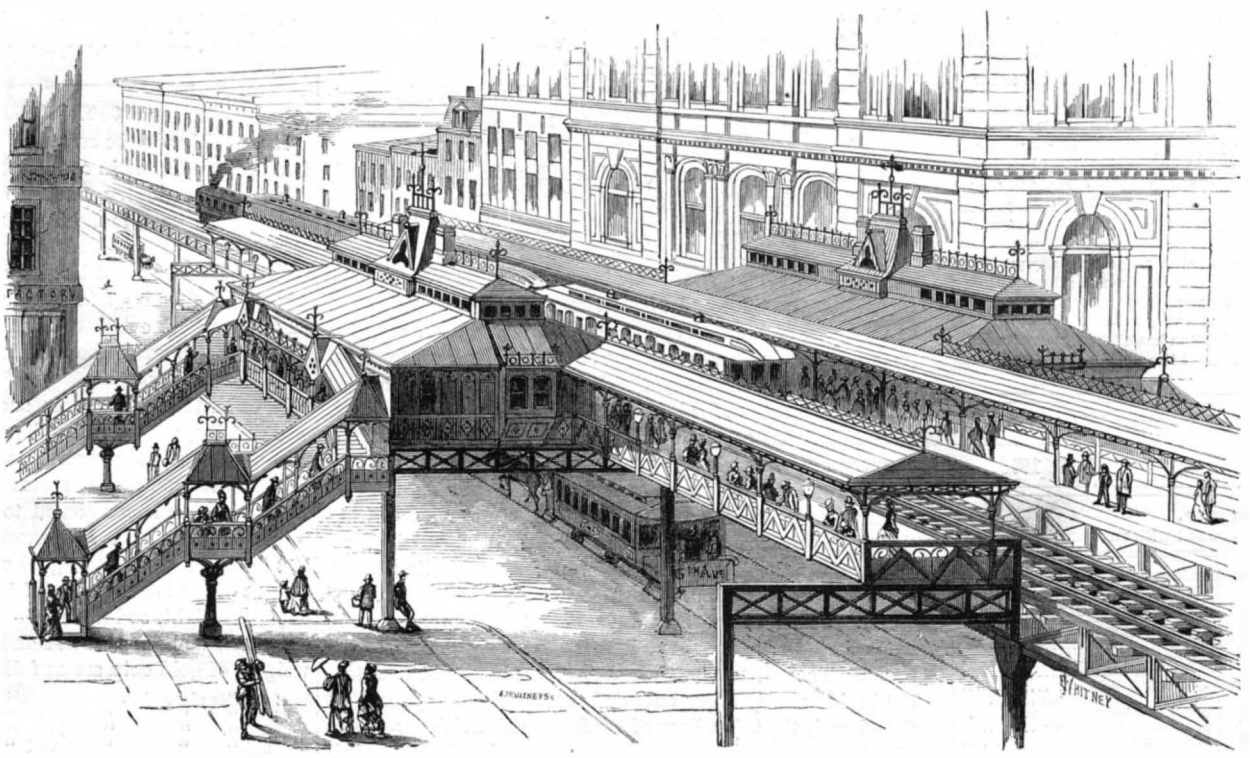

Fig. 1.—ELEVATED RAILROAD STATION, 23D STREET, NEW YORK

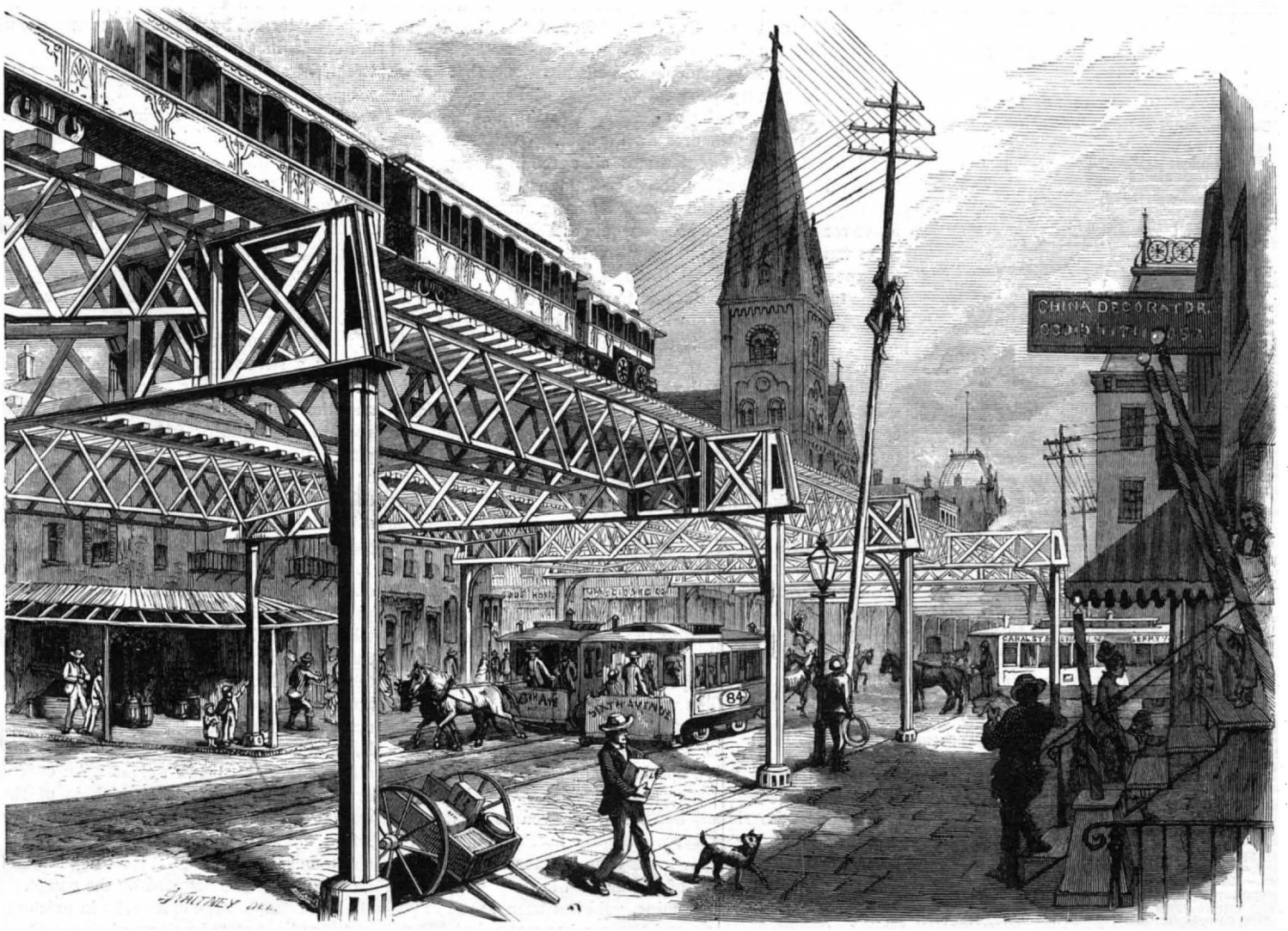

Fig. 2.—ELEVATED RAILROAD, WEST BROADWAY AND CANAL STREET.

Eels Attacking Shad.

The Hartford (Conn.) *Times* says: "Eels often attack the shad in the nets, after the shad have been caught in the river. They enter the shad at the gill openings, and suck out the spawn and entrails, leaving the fish perfectly clean. Fishermen say that the shad thus attacked are the best, for the eels will not enter any but the fattest fish. Eels also follow the shad all the way up the river, and devour the spawn. Were it not for these natural destroyers the shad would increase to an amazing extent."

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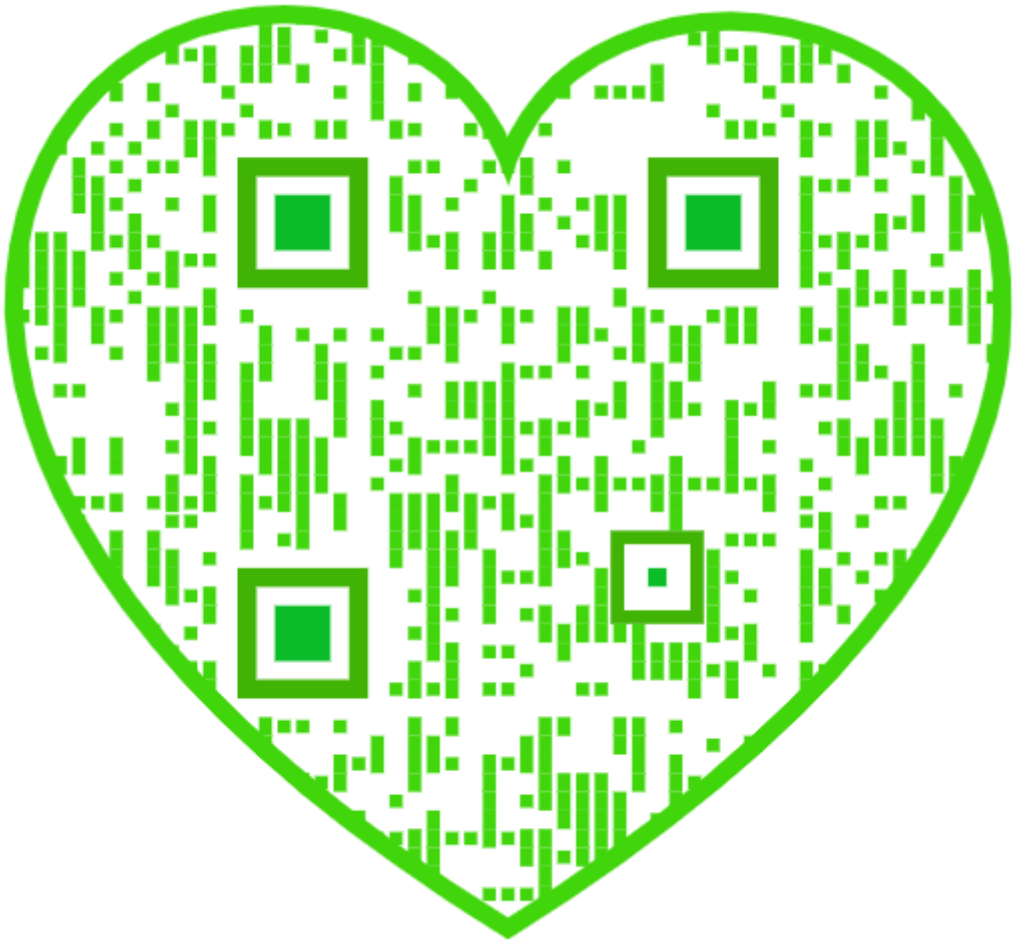

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NEW YORK, SATURDAY, JUNE 15, 1878.

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III. CHEMISTRY AND METALLURGY.—The Liquefaction of Oxygen and Hydrogen and the Solidifying of Ether. By RAOUL PICTET. The early conception of Heat. Discovery of Latent Heat. The Theory of Atomic Motion. Boyle's Law. Vapors and Gases. Phenomena of Cohesion. Table of the Measures of Oxygen, Hydrogen, and Nitrogen up to a pressure of 100 atmospheres. Explanation of the Action of Cohesion and Repulsion in Gases and effect of Heat, and consequent conditions necessary to Liquefaction. How the Permanent Gases were Liquefied. M. Pictet's Astonishing Experiment. Hydrogen solidified. Properties of solid Hydrogen.—Liquefaction of Gases. Liquid and Gaseous states continuous. M. Cailletet's Success, with description and a figure of his Apparatus.—Improved Gas Absorber. By G. GORE, F.R.S. 1 figure.—The New Metal Gallium. Interesting Account of its Discovery. Its Properties. Crystallization. Gallium Leaf. New Compounds of Gallium. Glucinium. By L. F. NILSON and O. PETERSON.—Japanese Isinglass. By H. N. DRAPER.—Gallium. By M. BERTHELOT.—Action of Oxygen upon the Acid Chlorides, Bromides, and Iodides of Aluminum. By M. BERTHELOT.—New way of Separating Arsenic from other Metals. By MM. DE CLERMONT and FROMMEL.—Dibromide of Acetic Acid. By C. HELL and O. MÜHLHÄUSER.

IV. ELECTRICITY, LIGHT, HEAT, ETC.—Hughes' Telephone. How sonorous vibrations are converted into undulatory electrical currents by unhomogeneous conducting substances placed in circuit. Instrument for testing the effect of pressure on various substances. A sensitive acoustical instrument. 6 figures.—A Projection Phoneidoscope By GEO. H. STONE.

V. ASTRONOMY.—The Coming Total Solar Eclipse. By J. NORMAN LOCKYER. Visible in the United States. Liberality of the White Star Line and the Pennsylvania Railway. Astronomers who will take part in the observations. Present state of eclipse observations. Young's work of 1869. Janssen's observations, 1871. Does the corona reflect? The solar spectrum. Chemistry of the sun's atmosphere. Solar photographs. Plates of varying exposure.

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SILVER MINING IN MASSACHUSETTS.

Early in 1873, considerable public interest was awakened and some speculative excitement aroused by the announcement in local journals of the discovery of mines in the vicinity of Newburyport, Massachusetts, which were yielding even at the surface ores rich in silver, and in some cases containing appreciable amounts of gold. The reports were, as is usually the case under like circumstances, greatly exaggerated, and those who expected to find gold in nuggets and silver in the native state were considerably disappointed to encounter both metals only in the form of sulphurets, the one occasionally in auriferous pyrites, the other in argentiferous galena and in gray copper (tetrahedrite). The first assay of the new found galena showed that one ton of the ore represented a value of $179, lead and silver together, the latter existing in the proportion of 68 ounces to the ton, and as other trials resulted in even more promising data measures were at once set afoot to develop the mineral resources thus brought to light. With the speculative mania which ensued, whereby land hitherto deemed little more than a rocky desert suddenly became exceedingly valuable, and with the vicissitudes of the numerous concerns which were started to mine the precious metals, it is not our purpose here to deal; especially as at the present time the era of speculation seems to have gone by, and several mining experts of long experience in the silver mines of the West have entered (though in a limited way) upon the systematic development of certain veins, which offer, we are informed, every indication of large and valuable yields.

The region where the ores abundantly exist (for it is scarcely possible to break an outcropping rock without finding traces or even a good showing of galena) is a barren and forbidding tract, located about two miles to the southwest of the town of Newburyport. Over how large an area the metalliferous deposit extends no two estimates seem to agree. The geological formation, or rather lack of formation, almost defies classification, for it is evident that great natural forces have here been at work both to roughen the face of the country and inextricably to intermingle the strata. The metal bearing veins are known to ramify over an area of five by two miles, for a shaft sunk almost anywhere within these limits is reasonably certain to strike ore, and it is reported that in reality the metalliferous beds underlie a much more extended region. There is hardly a farmer in the vicinity who has not dug down and found ore, and mere well digging has brought to light some remarkably fine deposits. These little shafts, however, can hardly be counted, but beside nearly every one, and most of them appear to be abandoned, there is a heap of ore from which rich specimens of galena can easily be picked out. Occasionally this shallow excavation demonstrates the existence of a large vein, as in the case of the so-called "Big Quartz Vein," which, though prospected only to the depth of 30 feet, is found to be 18 feet wide on the surface, with outcroppings at a distance of some 2,500 feet. It lies between a wall of feldspathic trap or greenstone on one side, and a talcose slate on the other, and surface assays yield gold and silver in about equal value to over $20 per ton.

It may be said of all the mining operations thus far conducted in the vicinity that they are little more than surface prospecting, a fact clearly apparent from the details of some of the principal mines given further on; and we are assured by experts, who have made special examinations, that deeper mining offers every prospect of substantial success. The difficulty, however, is lack of capital to put up the necessary works for treating the ores on the spot. Owners and parties interested in different mines all agree in stating to us that a mill, capable of handling the 200 tons (rough estimate) per day taken from the principal shafts, would probably prove remunerative to whoever would establish it; but where there were so many small disunited interests it was useless to expect the same result through co-operation. The fact seems to be that the mines that are still worked require all the available resources of the owners to keep them free from water, and the ore that is taken out simply lies in heaps in the sheds.

The mine known as the Merrimac is the largest, and besides has the most extensive plant. It is under the superintendence of Mr. Edgar Shaw, who informs us that one pocket of gray copper that was encountered in it yielded 8 tons of ore, which was sold at $2,150 per ton in Liverpool. The pay streak of galena now being worked is 2 feet wide, and thus far 312 feet long, yielding about $70 per ton. The shaft has a depth of 200 feet. This mine has been open about five years, and has paid 12 dividends, showing a net profit of about $80,000. Owing to a defalcation and loss of funds its operations are at a standstill, although a new milling plant for concentrating the ore by the Hooper process has just been erected.

The China mine was opened in last September, and has a shaft 90 feet deep. The vein being worked is about 4 feet in width. About 300 tons of ore have been taken out, averaging in value $200 per ton. Gray copper assaying as high as $1,000 per ton, a few specimens of ruby silver, and considerable zinc are also reported to have been found. Of the other mines, the richest bonanza is believed to exist on the so-called Noyes property, where gold in the proportion of over 20 dollars' worth per ton is found in auriferous pyrites, besides a rich showing of silver in the gray copper and galena. In the Newhall mine, gold has been found in patches in the gray copper, and the ore has assayed at $26 per ton.

The other mines are sinking shallow shafts, and are worked in a spasmodic manner, as the owners have funds to devote to them.

So far as our superficial inspection of the mining region, and as the statements of those familiar with the operations extended, there seems to be no reasonable doubt as to the existence of the large metal bearing deposits alleged to exist. Nor in view of the general prevalence of rich looking ore already on the surface, and the results of apparently well authenticated assays, does it seem improbable that the value of the deposits is in any degree less than the experts on the spot allege. As to whether the refractory ores can practically be manipulated on the spot, so as to pay, and whether the products of the mines will hold out in uniform richness, these, besides many others, are questions for the mining engineer to answer after proper examination of the present status of the field. It is but right to say that the value of the mines has been disputed, and there seems to be a lack of exact information relative to them which suggests the idea that it might be to the interest of mining experts, as well as of public importance, to have more extended surveys and investigations made at an early day. Assays of specimens of galena, collected at random from numerous ore heaps at the mines, yield an average of $27.96 per ton in gold and silver.

COUNTERFEIT COIN.

It would hardly be supposed that so large an amount as two million dollars in counterfeit silver and gold coin is now afloat in this country, but such, according to the estimate of Treasury experts, is the fact, and, moreover, the total is constantly increasing. This spurious money passes through thousands of innocent hands, until finally it is caught in the meshes of the nets laid by the Secret Service or is recognized by a lynx eyed expert in some large bank. Then the unfortunate holder becomes the victim of the counterfeiter's skillful rascality.

In order to imitate a coin successfully—that is, so that it will deceive, not the general public, because probably most persons never take a second look at the coin they receive, provided its appearance seems right, but the clerk or cashier moderately well accustomed to handling money—the counterfeiter must regard both execution, size, and weight. The last is most important in gold coin, because the least current weight of the latter is established, whereas in silver a coin of light weight, so long as the reduction is not manifestly too great, will pass. The standard weights and least current weights of gold coin are as follows:

20	dollar piece—Standard,		516	grains;	least current weight,		513·42
10	"	"	"	258	"	"	"	256·71
5	"	"	"	129	"	"	"	128·36
2½	"	"	"	64·5	"	"	"	64·18

Any decrease in weight below the latter figures subjects the holder to a loss equivalent to the difference. This decrease may occur by wear, or, as is very often the case, through sundry nefarious processes, which, though not properly counterfeiting, nevertheless belong to that species of crime.

These operations are perhaps the most dangerous to the community, because as a rule the coin preserves its appearance, is apparently genuine under the acid test, and in fact is genuine except in weight. It is impossible, for example, to tell whether a coin has been "sweated" or not without weighing it, and by sweating is meant the use of the coin as the anode in the electroplating bath, the gold being abstracted from it and deposited on another surface. Of course a uniform quantity is removed from the entire surface, and the imprint retains its original sharpness. As much as two dollars' worth of gold is sometimes taken from the double eagle in this way. A less scientific plan is one too commonly adopted by conscienceless jewelers, who when they want a little gold, instead of buying the precious metal, purchase a twenty dollar piece, file off with a dead smooth file a sufficient quantity, reburnish the place, and pass off the coin at full value. The most extensive fraud perpetrated on gold coinage is "splitting." The operator uses a fine saw to split the coin neatly in two. Then he gouges the gold out of the center until only a thin outside shell is left, and substitutes a silver and platinum alloy for the metal thus abstracted. The two parts are then joined with gold solder, and the edge is remilled. In this way, we are informed, gold to the value of $15.50 has been taken from a single piece. The operation, however, generally destroys the ring or tone of the coin, leaving it, besides, either too light or too thick. Another swindle is to bore into the edge, and it is said that John Chinaman favors this game, buying up the pieces, sending them to China, so that his dexterous compatriots may there manipulate them in safety, and subsequently reimporting them to set them adrift upon the unsuspecting American public. The holes whence the gold is taken are refilled with silver, covered with gold solder, and the edges are neatly finished; but the light weight reveals the theft. From 5 to 7½ dollars' worth of gold has thus been taken from one coin, and the pieces of course have every appearance of being genuine. Real counterfeits—that is, coin wholly spurious because made of base metal—are almost invariably below weight. An exception to this, however, exists in a $5 piece which is of the exact standard weight of 129 grains. It is composed of an alloy of gold and silver, and is worth from $2.70 to $3.40. Its appearance and tone are excellent, but it is thicker than the genuine coin, and hence may be detected by the gauge. Still it is one of the most dangerous counterfeits in existence.

As we have stated a silver piece passes current so long as the imprint is not badly defaced or weight greatly reduced. A hole through the coin, however, condemns it—a fact, we

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believe, not generally known. The low value of silver prevents any such proceedings as in the case of gold, as the amount which could safely be abstracted will not pay for the trouble of doing it. Consequently all silver counterfeits are true imitations, and there is hardly a date of dollar, half dollar, or quarter which has not been copied with remarkable accuracy. The counterfeiter either makes a mould in plaster from the real coin and casts from it, or he stamps his imitation in dies. As this last process is the same as is in use in the mints, the counterfeits thus produced are more difficult to detect, because, besides being more accurately finished, the compression which the alloy receives brings it nearer to standard weight. A large number of counterfeit silver coins are made chiefly of type metal. A very dangerous half dollar is composed of silver, copper, and zinc, and is worth about 17 cents. It is from 7 to 10 grains too light. Spurious half dollars have appeared which constantly deceive bank tellers and other experts because they are of full weight. They are made of a compound similar to German silver, and are so well plated with genuine silver that the acid does not affect them. They are, however, too thick, and the gauge, as usual where the balance fails, shows the fact. Counterfeits of the quarter dollar, though very plenty, are less dangerous than those of larger pieces. They are composed of antimony, tin, and lead, and are both too light and too thick, although they have a good ring. A peculiar composition has been employed, to which powdered glass is added to give a clear sound; but this is but a clumsy expedient, as the coin is far below proper weight, a fact easily appreciable by mere handling.

It is a difficult matter to lay down any general rules for detecting counterfeit coins, as it will be seen from the foregoing that the closest ocular inspection may be wholly at fault. One of the most ingenious little mechanical contrivances for both measuring and weighing coin, and which has, we are informed, been adopted in the United States mints and Treasury and many banks, will be found illustrated in our last issue. In general the milling on the edge of the counterfeit coin is always poorly executed as compared with the genuine; but wear of the latter often renders the distinction difficult to draw.

Another point worth remembering is that absence of clear tone in a coin is not necessarily proof of its falsity, because it may and does happen that a crack or flaw is made in the metal during the rolling, and this, just as in a bell, will of course destroy the vibrations and make the sound dull and flat.

ARTIFICIAL FUEL.

It is well known that owing to the brittleness of anthracite there is a large waste in mining it. The comminuted material being too fine to be merchantable has accumulated in immense heaps near the mines, cumbering the ground and at the same time standing as tangible evidence of the necessity of some means for its utilization. Processes for this purpose have not been wanting, and when they failed as many have it was frequently because the fuel in the heat of the furnace lost its form and choked up the grates, but more commonly because the cost of manufacture was such that competition could not be made with the lump coal. Inventors of artificial fuels based on anthracite culms too often overlook the fact that the success of their process necessarily includes an increase in value of the culm in proportion as the demand for it is augmented. Says Mr. Frederick Prime, in his report as a judge at the Centennial Exposition on "coals:" "As quickly as this value touches a certain point it then becomes impossible for the artificial fuels to compete with the lump anthracite. Nor can they do this even when the culm is obtained for a mere song when the price of anthracite is very low. Consequently it is very probable that the manufacture of artificial fuels will for many years be limited, both as to quality and the purposes for which they are used."

The principal processes introduced of late years are the Loiseau, the Newton, and the Endres. The first is the invention of Mr. E. F. Loiseau, and has achieved remarkable success both in this country and abroad. It is claimed to be the first ever used to make artificial fuel for domestic employment by mechanical processes on a commercial scale. We illustrated Mr. Loiseau's ingenious train of machinery some four years ago, and its operation can be briefly summed up. The anthracite dust, after being dumped on a covered platform, is received on a screen, which after screening the coal delivers it to an elevator which raises and discharges it into a bin. Meantime dry potter's clay is suitably ground, and in a separate tank a liquid mixture is made of lime, rye flour, and water; 95 per cent of coal dust and 5 per cent of clay are mechanically taken from the bins, delivered under a chain elevator, and there sprinkled through a perforated pipe with the liquid composition. The compound is conducted between rollers, in which are cavities which mould it in egg shaped form, thence passes to a drying oven, through which it passes five times to and fro on a belt, thence the lumps are carried through a waterproofing composition, and finally they pass through a drying oven, emerging perfectly dried and ready for the market. This fuel burns well, retains its form, and leaves as a residuum the clay and any other solid impurities besides the ash.

Newton's fuel has not yet been produced on a manufacturing scale. It is composed of coal dust and coal tar, placed in a retort, which distills out the volatile products, the residue of the coal tar, some 2·5 per cent, remaining behind as a binding medium. Mr. Prime in the report before us says that the product seemed too friable to stand much handling without particles of the coal wearing off from the lumps, but it burns freely, without smoke or sulphurous fumes, and if left untouched retains its form until consumed. It is more friable than the Loiseau fuel, but leaves less ash.

The Endres process is worked by the Anthracite Fuel company of Rondout, in this State. It uses 100 parts anthracite culm to 10 parts "fuel pitch" or bitumen of coal tar. This pitch is previously prepared by passage through crushing rollers, and it is mechanically combined with the coal in exact proportions. The mixture is then heated, the pitch melting, and it is afterward moulded under heavy pressure into bricks weighing about 15 pounds each. This fuel Mr. Prime states to be a steaming coal of uniformly high average. During 1876 it was supplied to six railroads in New York and Connecticut, eliciting favorable reports from all. On the Hudson River Railroad the economy in its favor was estimated at about 15 per cent.

SILVER IN ART.

In a short but interesting article on this subject in the *International Review*, Mr. Edwin C. Taylor has described a few of the more novel methods of ornamentation of silver that have not yet become generally familiar. And, by the way, the author expresses it as his opinion that in view of the fact that the yield of this metal in our own country is destined, for years to come, to be greatly in excess of the natural demand, it would be far better to divert it to the uses of art than to make it the means of striking a blow at our national credit. In view of the late action of Congress, however, it would seem that our legislators are not disposed to regard metallurgy from an æsthetical standpoint.

Conspicuous among the newer methods of ornamentation of silver is that of inlaying with niello, somewhat after the manner of the *Champlerê* enamel, and similar to the much admired Russian work at our Centennial Exhibition. The art of applying this enamel was for a long time regarded as a Russian secret, although the metallic oxides, of which it is composed, were well known to our metallurgists, and it has lately been successfully employed by craftsmen of Paris and London. This valuable ornamental agent was developed in America only last year, and its use in connection with silver offers the greatest advantages, from the fact that it can be worked with equal facility in mass or in the most delicate lines. Niello, unlike the vitrified enamels used in *Cloisonné* ware, will bend with the body in which it is inserted, and is therefore not liable to destruction through fracture or abrasion. In connection with this very flexible composition, pure metals, such as copper, iron, and gold, are also inlaid by an ingenious process, so that it is possible to obtain a durable surface possessing the beautiful polychromatic effects that were but lately produced only by superficial methods of decoration, such as electro-plating and oxidation.

Another method of silver ornamentation, which has proved to be susceptible of rare delicacy of treatment, is that styled *Appliqué* work.

In this process each ornament is first separately wrought in the same manner as a piece of jewelry, laid upon the surface to be embellished, and held in place by ligatures of fine wire, while a careful blast from a blow-pipe directed upon it secures perfect fusion between it and the original body. In this way Japanese figures of birds, fishes, foliage, and Persian ornamentations of floral and other decorations may be admirably treated. By this process of applying raised ornament, too, another feature of decoration is introduced, which, until the current year, has never been known outside of the curious workshops of the jealous Japanese, into whose precincts the foot of the "barbarian" is never allowed to enter, nor his eye to peer.

The material used in this process may be call "Japanese alloy," and it is applied in the manner described in regard to raised ornaments of silver. This alloy is composed of certain metallic substances that are capable of receiving and retaining various shades of color, such as blue-black, gray, yellow, brown, violet, and vermilion, used separately or together, or mixed with gold. "The opportunities for metallic decoration which this wonderful and highly valuable compound affords are vast indeed, and render it easy to present the gorgeous plumage of birds, and all the beautiful hues which the wealth of nature yields, in the durable form of metal objects." The discovery of this secret in metallurgy is the result of a long series of patient experiments, and its development will be watched with great interest by those who are accustomed to follow the progress of American industrial art. It is said that the use of this alloy, yet in its infancy here, "is likely to result in the production of rarer and costlier art objects of silver than modern art has known, and the chryselephantine treasures of archaic times will doubtless be rivaled by the many-colored products of American workshops."

In conjunction with the various kinds of ornamentation, a very peculiar and quaint effect is sometimes produced by leaving the entire surface of the object impressed with the dints of the hammer. This finish imparts an appearance not unlike that seen in the Chinese "crackle" pottery. Sometimes the objects are indented with an edged hammer horizontally, so that the lines appear like waves of water. And in connection with this, a very novel and pleasing effect is produced by the introduction of raised figures of fishes and marine plants.

In noting these novelties in connection with the development of metallurgy in our country, it is gratifying to feel that we possess artisans of such skill that no foreign secret processes are beyond their power of grasping, and that our people have the taste and the will to encourage their efforts.

FORMATION OF PLANETARY RINGS AND SATELLITES.

According to the great nebular hypothesis of Laplace, the planets owe their formation to the abandonment of zones of vapors which the primitive solar nebula left at the limits of its atmosphere, when, through the effect of cooling and contraction, the velocity of rotation of the mass progressively increased. These rings of vaporous matter ultimately condensed into separate nuclei, constituting the planets, which consequently at the beginning had the same constitution as the solar nebula. "In this state," says Laplace "the planets perfectly resembled the sun in nebulous condition," and they became rings and satellites circulating around their primary in the same direction as the movement of rotation of the latter, and turning on their own axis also in similar direction. All bodies which circulate around a planet having under this hypothesis been similarly formed by zones which its atmosphere has successively abandoned, and its movement of rotation having become more and more rapid, the duration of this movement should be less than that of the revolution of these different bodies, as in the case of the sun as compared with the planets. All this is confirmed by observation."

This at the time when Laplace wrote was true. The movement of the moon, for example, is 28 times less considerable than that of the earth's rotation; the first satellite of Jupiter, nearest to the planet, revolves in 1¾ days, and its movement is four times less rapid than the rotation of Jupiter, which occurs in 9 hours and 55 minutes. Mimas, the satellite of Saturn, having the shortest period of revolution, about 23 hours, moves in more than double the time required for the rotation of the primary, and even the nearest brilliant Saturnian ring turns about $\frac{1}{10}$ of a day less rapidly than the planet itself. All this accords with Laplace's law.

The newly discovered satellites of Mars render the system of that planet analogous to that of Jupiter, Saturn, or Uranus. But the first satellite of Mars, the distance of which from the center is 2·7, or less than three times the radius of the planet, makes its siderial revolution in a period of about 7½ hours only, three times less rapidly than the rotation of the primary is accomplished.

M. Edouard Roche has recently published an essay wherein he advances a new theory to account for this remarkable anomaly. He considers that during the contraction of a nebula there is not merely, as Laplace suggests, an abandonment of exterior rings, condensing at the equatorial limit where the central attraction equilibrates the centrifugal force. The portion of the nebula, he says, which becomes free at each new stage of cooling comes from a fluid layer which extends to the poles, and which is diverted on both sides, to meet finally outside by the equatorial line as by a sort of opening. It results that in flowing to the equator, one part of this nebulous matter arrives there with too low a velocity to allow of its circulating internally. The result of this is, that instead of separating from the nebula to form exterior rings and later satellites analogous to those known, this matter, re-entering the atmosphere of the nebula, forms there interior rings, which, at first describing more or less elongated ellipses, end by being transformed into circular rings. One part of Saturn's rings appears to be due to this mode of formation, and the same theory is advanced as accounting for the anomaly observed in the first satellite of Mars.

The Lighthouse Board.

The decease of the distinguished Professor Henry left a vacancy in the United States Lighthouse Board, which has lately been filled by the appointment of Professor Henry Morton. This gentleman is well known in the scientific world for his experimental researches and discoveries in connection with light and the appliances for its production. His appointment will give very great satisfaction.

As President of the Stevens Institute of Technology, Hoboken, N. J., he has conducted the affairs of that institution with judicious skill, and has evinced the possession of executive abilities of a high order. He was, in fact, the organizer of the institution, which under his auspices has come to be widely celebrated for excellence.

The lighthouse system of the United States is under the control of a board of seven persons, consisting of two naval officers, two army officers, two civilian scientists, and a naval secretary. The Secretary of the Treasury is the President of the Board and controls all its decisions. But we cannot doubt that the influence of Professor Morton will prove useful to the Board, by helping to renew its vigor, and perhaps by assisting to increase the luminosity of some of our lighthouses.

American Society of Engineers.

The tenth annual convention of the American Society of Civil Engineers will be held at Boston, beginning Tuesday, June 18, 1878. The list of topics to be considered is a long and interesting one, and the programme includes a number of excursions to points of professional interest in and about Boston. The meetings of the convention will be held in the hall of the Massachusetts Institute of Technology.

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A Long Way to Pasture.

Mr. John M. Wilson, United States Consul at Hamburg, reports that the exportation of live stock from this country to Schleswig-Holstein, to be fattened on the rich pastures of that country, bids fair to become a very lucrative business. At the suggestion of Deputy-Consul Moeller, a native of Schleswig-Holstein, the grazers of that province sent a steamer to this city for a cargo of lean cattle, which were purchased at Chicago, and a few fattened animals for the English market. The latter numbered 107 specimens of good stock, 1 buffalo, 15 horses, and 86 hogs, and were all sold at Southampton at high prices. The lean cattle, 320 in number, arrived in Schleswig-Holstein in excellent condition, and compared favorably with lean Denmark stock. Another cargo was sent for at once, and since the cost was much less than similar animals could be got for anywhere in Europe, there is a good prospect that the United States will be looked to hereafter for the entire supply for these rich pasture grounds, where thousands of cattle are fattened every year for the markets of France, Germany, and England.

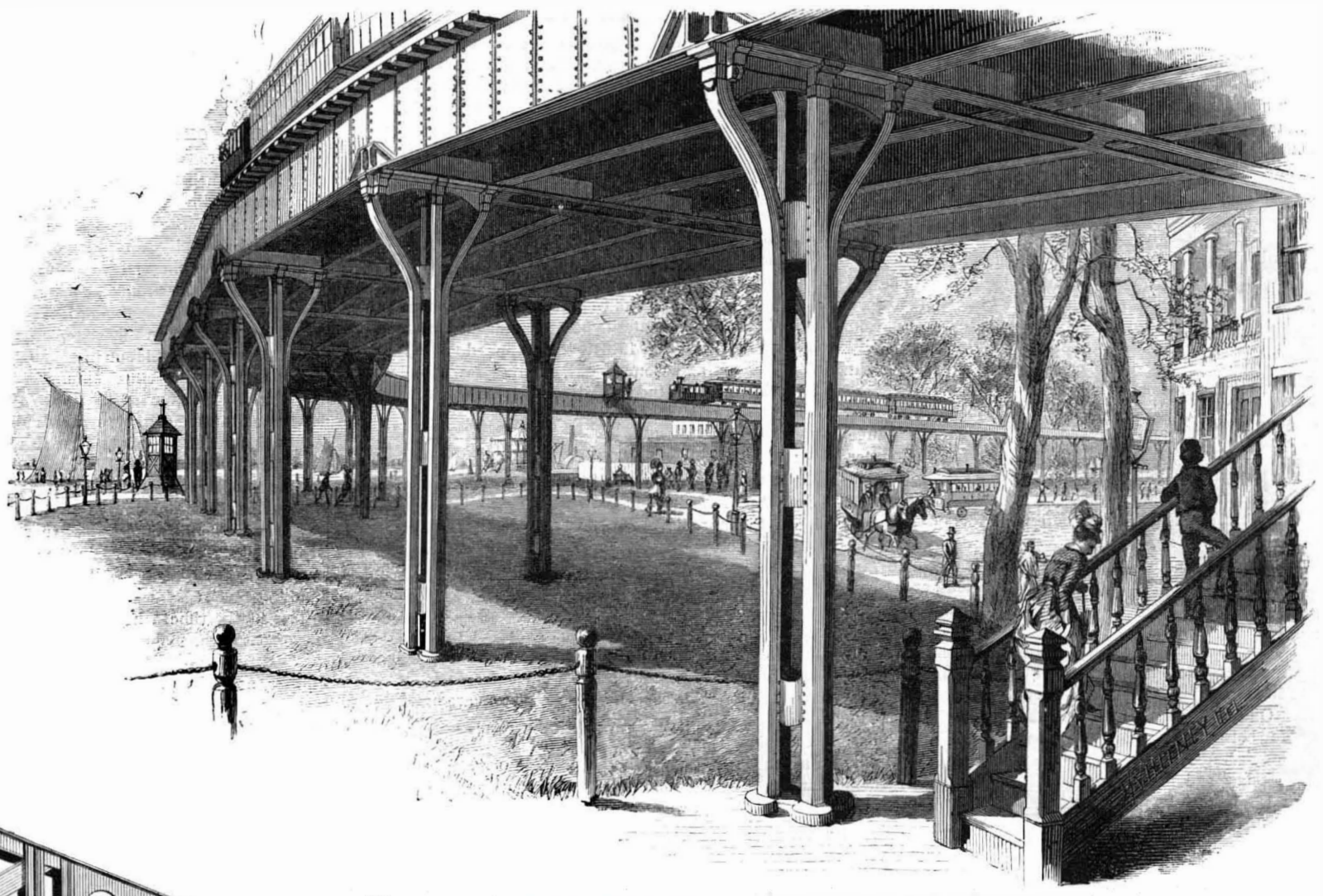

Fig. 3.—NEW YORK ELEVATED RAILROAD AT THE BATTERY.

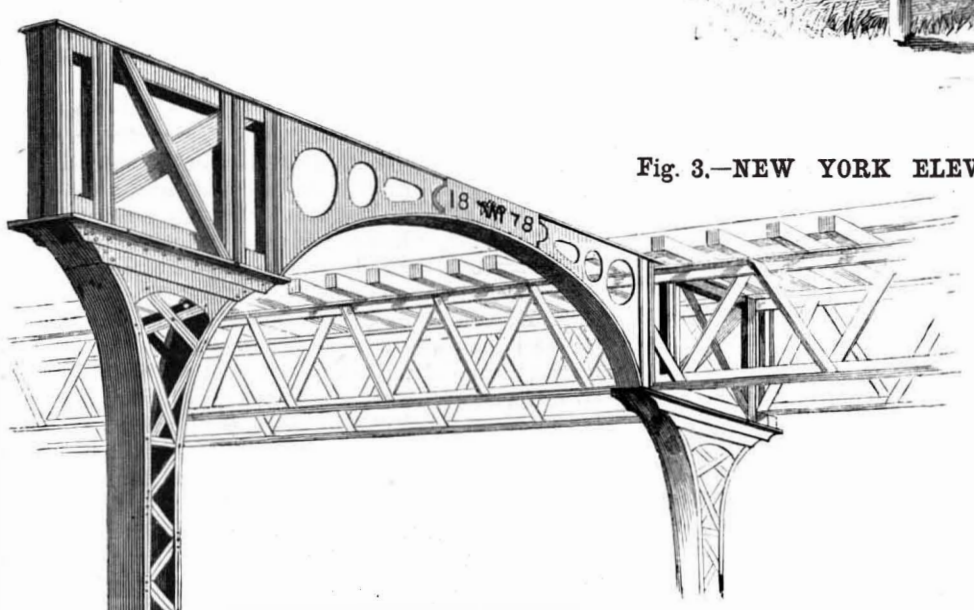

Fig. 4.—MODE OF CONSTRUCTION ON THIRD AVENUE.

Asphaltic Wood Pavement.

Recently at the Society of Engineers, London (Mr. R. P. Spice, President, in the chair), a paper was read by Mr. Henry S. Copland on "Modern Roadway Construction." The author first adverted to the extent to which the work of road making was constantly going on at the present time, and noticed the progress made by the various nations of antiquity, the state of decay into which the medieval roads had been allowed to fall, and the various attempts made to improve them since the beginning of the present century. He then described the principal systems of roadway construction now in use, and pointed out the extent to which, he considered, they met, or failed to meet, the requirements of a good modern roadway; namely, safety, easy traction, noiselessness, freedom from dust and mud, durability, facility, and cheapness of construction, maintenance, and repairs to itself, and to the gas and water mains, etc. He explained the principles upon which, with a view to avoiding the defects of previous systems, he had designed the asphaltic wood pavement, the use of which was now increasing. This pavement consists of a bed of concrete, with a layer of asphalt over it. Upon this are laid transverse courses of red pine blocks, with intermediate spaces. The spaces are filled in partly with heated mastic asphalt, and then with coarse lime and gravel grout, flushed with hot air, to the surface of the roadway. About an inch of coarse gravel is then spread over the roadway and left to be worked in by the traffic. The author finally examined into the expense of construction and maintenance of the various systems of roadway, drawing the conclusion that though, for town roads, macadam was the cheapest in original cost, it was by far the most expensive over a term of years, whereas, although his asphaltic wood pavement cost more at first, it was cheaper, over a lengthened period, than macadam, or most other roadways; and would compare favorably with other systems, in that and most of the requirements of a good modern roadway.

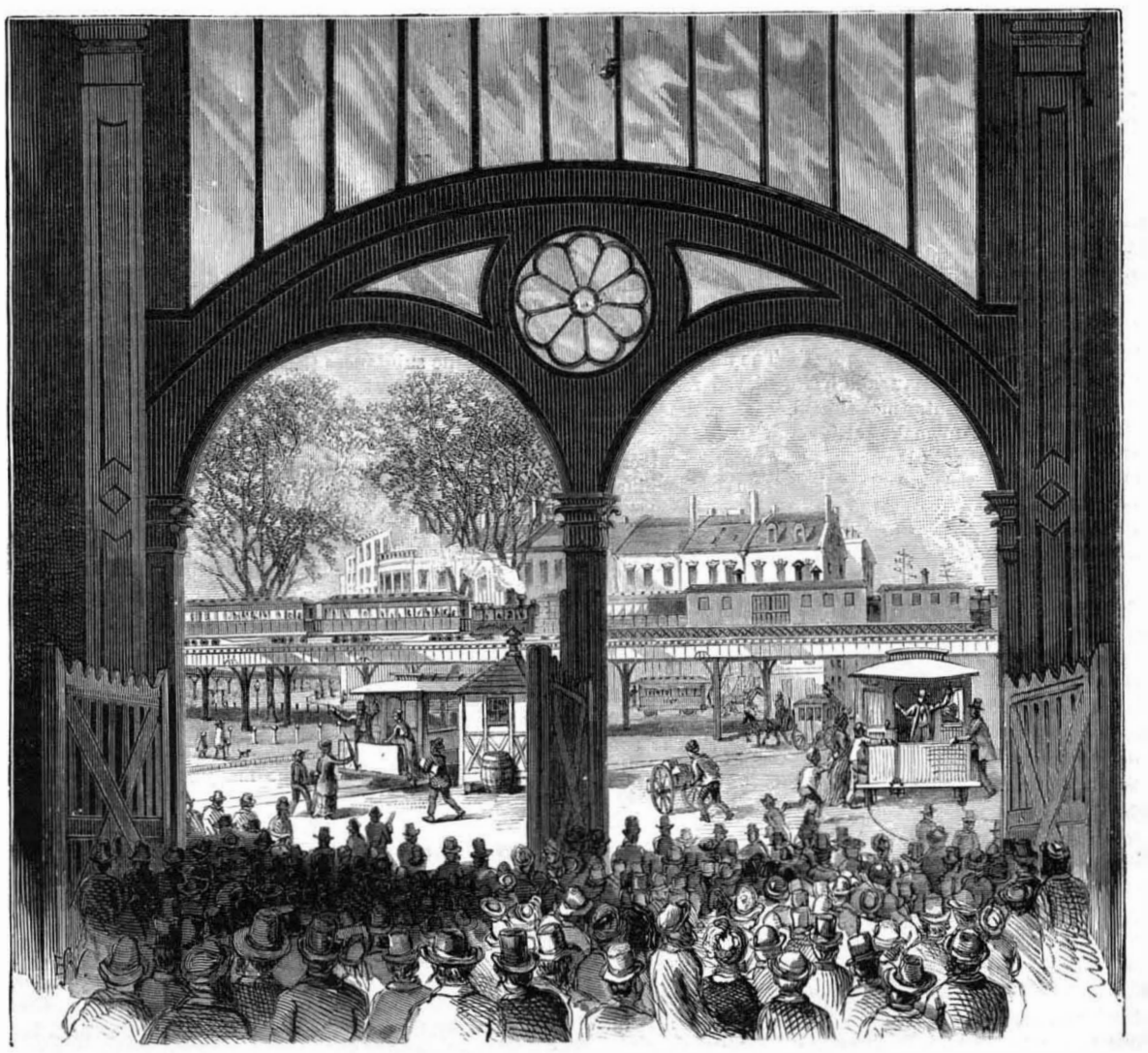

Fig. 5.—NEW YORK ELEVATED RAILROAD STATION AT SOUTH FERRY.

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VERTICAL ENGINES AND BOILERS.

There are certain excellences sought after by nearly every builder of steam engines, namely, economy of fuel, regularity of speed, simplicity of mechanism, durability and freedom from derangement, power with a given size of cylinder and pressure of steam, and, lastly, elegance of design and finish.

In stationary and steam yacht engines we find an infinite variety of construction, some of unsymmetrical form, roughly constructed, with slight finish, and again others having every improvement that is considered really such by the designer, with elaborate finish and beautiful but simple mechanism. As an illustration of the latter class we have selected some engines constructed by the New York Safety Steam Power Company, of New York city. Fig. 2 represents a form of engine they construct for yachts and launches; the engraving is taken from one of ten horse power. Engines of this class are fitted with link motion for reversing, and are furnished with notches for working expansively. The outline of this engine is one of great elegance, and the disposition of the moving parts is compact without being too confined for examination and oiling. Fig. 1 represents the steam launch Barrancas, one of the many built by this company. This one was built for the Quartermaster's Department, U.S.A., and gives a very good idea of this class of boats. She is 61 feet long over all, 10 feet 10 inches beam over the fender strakes, 4 feet 6 inches draught aft. The after cock pit is 20 feet 6 inches long, and the forward one 11 feet long, the average width of both being 8 feet 6 inches. The total length of seating, including thwarts, is 78 feet. Fig. 3 shows a combined vertical engine and boiler which may be properly considered semi-portable. This form is suitable for a great variety of small industries to which motive power can be advantageously applied.

The engine is not fastened to or upon the boiler, and is, therefore, not affected by the expansion, nor are the bearings overheated by conduction or the ascending heat from the boiler. The boiler is a patented vertical tubular one, with internal fire box, and, we are informed, is made of the best material and workmanship. The heating surface and area of grate, it is claimed, are in excess of the quantities usually allowed for the same power. The engine and boiler are placed on a base, which also supports the boiler, forms the ash pit, and contains the feed water heater. A neat arrangement collects all the drip from the stuffing boxes, the bearings, and the pump, into one cup, where it can be conveyed away as desired. The exhaust steam is discharged through a blast pipe in the stack. The fly wheel being at the base secures steadiness under the high speed which is necessary for economy of fuel.

At the rooms of the Company, 30 Cortlandt street, New York city, are a fine stock of engines for various purposes, and numerous models of yachts, fast pleasure boats, and launches, some of them of unusually graceful proportions.

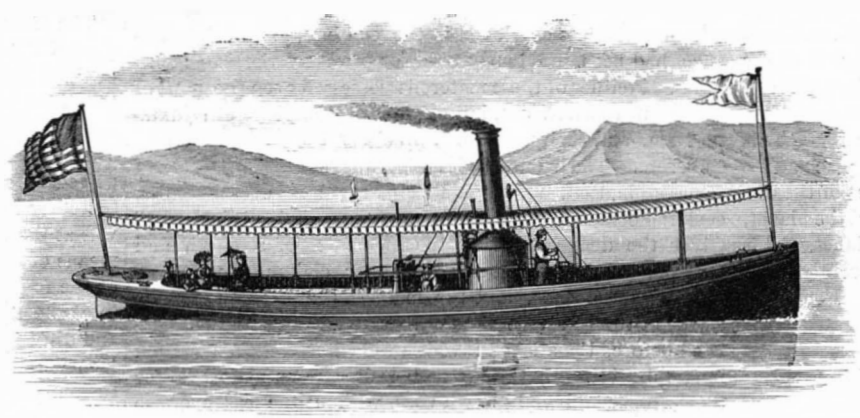


Fig. 1.—STEAM LAUNCH BARRANCAS.

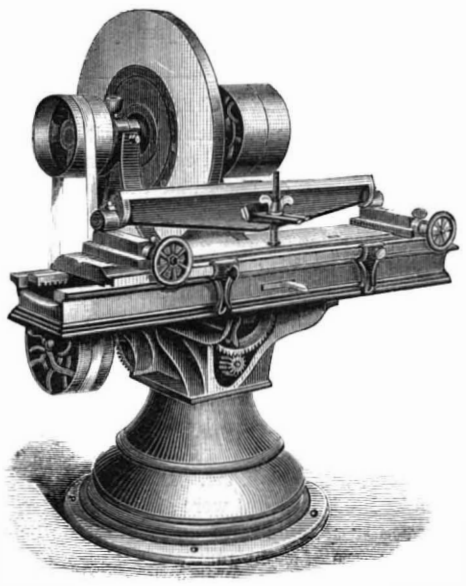
SCHOOL SHOPS.

Not merely shops of the nature of the kindergarten for older children, or of affording the rudiments of a knowledge of the trades as now practiced in America, but shops affording a knowledge of the many practical industries not now established in America. Little shops which teach other uses of raw material than those now known, and incite to the establishment of workshops which shall grow to great industries. One crying defect of the eager superficial system of most American teaching, either in books or schools, is that there are no handbooks of practical information from which a knowledge of the production of a great number of articles may be obtained. Since the labor societies and the compulsory school laws keep boys still more from apprenticeships, there should be a series of cheap practical handbooks within the reach of every boy, and, at the same time, so practical that a knowledge of the pursuit may be easily worked out.

Practical common sense shops, where a boy may earn his expenses and learn a trade, or, by paying for his night attendance, may learn the rudiments of any pursuit to such an extent as to be able to put his knowledge to practice. How few people in America know the nature and uses of clay, or know what clay is! Plaster of Paris, or how obtained, to say nothing of working it. Probably not one person in a thousand, in the United States, knows that placing a piece of limestone, so common all over the country, for an hour upon a coal fire, converts it into lime. This is not an isolated instance, but the rule is that the first rudiments of practical knowledge are not provided by books or schools, and until they are children will read trash and be ignorant of the means by which they may be useful citizens.

IMPROVED AUTOMATIC KNIFE GRINDER.

We illustrate herewith a new grinding machine for grinding and sharpening planer, paper cutter, and other long



AUTOMATIC KNIFE GRINDER.

knives used by belt makers, curriers, rubber and paper workers, etc. It is claimed that a long knife can be fastened to the machine, adjusted, and ground perfectly straight in ten minutes. A solid emery wheel with iron center is used, working at a speed of 225 revolutions. The platen to which the knife is bolted works similar to that in the metal planer, and can be instantly adjusted to traverse any distance from 2 to 36 inches. The advantage of the iron center is that it can be recovered after the wheel is worn down, thus saving the cost of a wheel of the size of the center. In this way only the emery actually used is lost. The present machine, we are informed, is manufactured with especial care.

All the gears are turned and cut; the spindle boxes are made in halves (same as for engine lathes), and are also fixed and permanent, requiring no adjustment as the wheel wears down. The spindle and all the shafts are made from steel. The bearings are made very long, and all parts of the grinder are interchangeable.

For further particulars address the manufacturers, the American Twist Drill Company, Woonsocket, R. I.

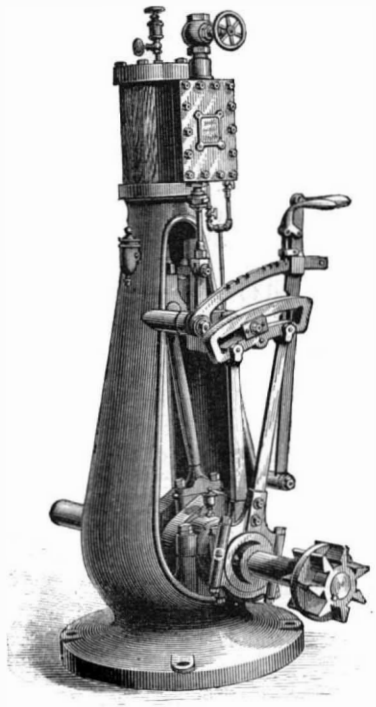


Fig 2.—10 H.P. LAUNCH ENGINE.

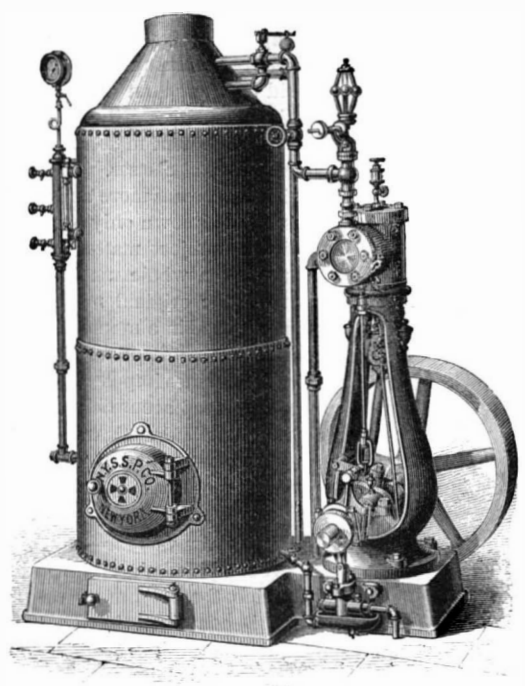


Fig. 3.—VERTICAL ENGINE AND BOILER.

London Water Works.

Nearly all the waterworks companies of the metropolis are actively engaged in providing a constant water supply, and the number of miles of streets which now contain mains constantly charged, and upon which hydrants for fire purposes could at once be fixed, in each district of the metropolis, is given in Mr. Frank Bolton's report for the month of March, as follows: Kent, 80 miles; New River, 196; East London, 85; Southwark and Vauxhall, 112½; West Middlesex, 70; Grand Junction, 41½; Lambeth, 70; Chelsea, 56; making a total length of 711 miles; the water companies are ready to affix hydrants thereon when required by the authorities. The total number of hydrants erected is at present 4,527, of which 2,813 are for private purposes, 542 for street watering, 697 for public use, and 475 in government establishments.

New Mechanical Inventions.

An improved Key for fastening the bosses of wheels and levers to their shafts has been invented by Mr. P. A. Oliver, of Wilkesbarre, Pa. It has a cylindrical threaded head, to which is fitted a sleeve or nut made externally polygonal to receive a wrench, by which it is turned in the operation of extracting the key.

A Spanish inventor, Señor Luis Ybarra, of Madrid, has introduced a novelty in Revolving Firearms, consisting in the addition of a special chamber for receiving from the rear end of the cylinder a portion of the gas resulting from the explosion of the cartridge, and conveying it to one of the discharged chambers, to expel the empty shell.

Mr. L. Murray, of Greensburg, Pa., has invented a Railway Frog, which, in its normal position, keeps the main line open, but yields sufficiently to the side pressure of the wheel flanges to open the side track for a train passing over it on that track. The tongue is pivoted to the bed plate, and its point is held to one of the main rails by a spring, to keep the main track open.

A new Channeling Tool, invented by Mr. C. K. Sharood, of Detroit, Mich., belongs to that class of machines employed to cut a channel and groove, for the purpose of holding the thread or nails used in uniting the soles and uppers of boots and shoes. The feature of Mr. Sharood's invention is a casting, adapted to be secured to the machine, having an inclined socket carrying a tubular cutter, which is adjusted by set screws as it becomes worn.

Mr. J. J. Peux, of Brooklyn, N. Y., is the inventor of an improved Crown Push for stem-winding watches, which is claimed to be so constructed as to render the crown entirely dustproof, prevent rattling, and permit the movement being taken out of the case without removing the crown or key pipe.

A novel Rotary Engine, the principle of which is also applicable to a pump, has been invented by Oscar Stenberg, of Helsingfors, Finland. It is based on the differential action of a number of pistons acted upon successively by steam or water, so as to revolve a common crank coupled to the pistons; and it consists of a casing with four interior cylinders at right angles to each other, and connected by a duct having suitable entrance and discharge valves. The four pistons are coupled to the wrist pin of a crank at the interior end of a shaft turning in a stuffing box of the cylinder casing.

Mr. Nelson McIntyre, of Princeton, Wis., has patented a handy Wagon Lifting Jack, which is self-supporting when the load is raised, and may be closed up in compact form for convenience in storage and transportation.

Mr. C. Palmer, of Springfield, Tenn., has invented a Machine for Sewing Brooms with Wires, consisting of a combination of mechanical devices for clamping the broom, holding the wire bands which surround the brush, guiding the transverse binding wires through it, cutting them, and binding them over the wire bands.

An improved Glove Sewing Machine, invented by Mr. C. M. Boland, of New York city, belongs to that class of machines for sewing gloves, furs, and similar work, in which are employed two parallel feed disks, a reciprocating needle, and an oscillating looper. Special details are introduced, among which are an adjustable guide arm for laying over the seam one or more ornamental face threads, and a revolving brush to clear the edges of fur from hairs in sewing.

Mr. R. S. Munger, of Mexia, Tex., has invented an improved Cotton Gin Saw Cleaner, consisting of a series of knives supported by a movable frame, which may be thrust between the saws, cleaning them rapidly. The knives are readily detached from their support when it is desired to sharpen them.

A new Nut Lock, patented by Mr. J. L. Hayward, of South Framingham, Mass., is formed of a thick rubber

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washer containing several steel pins, which are parallel with the axis of the washer, which, when the washer is compressed by the nut, act as pawls in preventing the nut from unscrewing.

Mr. S. F. Charles, of Cumming, Ga., has patented an Amalgamator of improved construction, intended especially with reference to saving "float" gold, in which the special feature is the use of a new amalgam cloth having silver amalgam and gutta percha in its interstices, claimed to be unusually durable and effective.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, June 15, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	3 29 mo.	Jupiter in meridian	3 02 mo.
Venus rises	2 21 mo.	Saturn rises	0 33 mo.
Mars sets	9 37 eve.	Uranus sets	11 07 eve.
Jupiter rises	10 08 eve.	Neptune rises	2 09 mo.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Alpheratz rises	10 34 eve.	Regulus sets	11 09 eve.
Algol (var.) rises	0 18 mo.	Spica in meridian	7 42 eve.
7 stars (Pleiades) rises	2 38 mo.	Arcturus in meridian	8 33 eve.
Aldebaran rises	3 57 mo.	Antares in meridian	10 45 eve.
Capella sets	9 40 eve.	Vega in meridian	0 59 mo.
Rigel rises	6 03 eve.	Altair in meridian	2 11 mo.
Betelgeuse sets	6 38 eve.	Deneb in meridian	3 03 mo.
Sirius sets	6 04 eve.	Fomalhaut rises	1 18 mo.
Procyon sets	8 15 eve.		

REMARKS.

The sun attains his greatest northern declination (23° 27′ 24″) and enters the constellation *Gemini* (sign *Cancer*) June 21, at which time summer begins. Mercury will not be visible until about August 10. Venus and Neptune are in conjunction June 11. At the time Venus rises Neptune will be about ½° northwest of her. This will be a good opportunity to search for Neptune. Jupiter is in conjunction with the moon June 18, 1h. 3m. morning. This is an occultation on this continent between 24° + and 55°— latitude, and here will be almost a contact of limbs, Jupiter being north of the moon. His fourth satellite disappears in an eclipse June 9, 11h. 33m. evening, and reappears at 3h. 43m. morning, 10th, having passed through the planet's shadow in 4h. 10m. This and all other eclipses of his satellites must take place at the west of the planet until July 25. At the moment of the disappearance of this satellite the third one is behind the planet, the second has just appeared from behind the planet, and is close to him upon the east, while the first has recently made a transit and is quite near him upon the west. For an inverting telescope reverse these directions.

Singular Effects of Carbon in a Blast Furnace.

In a communication to the Lafayette Chemical Society of Lafayette College, Easton, Pa., Mr. J. Gayley states that in November, 1877, the blast was taken off No. 4 Furnace at the Crane Iron Works, Catasauqua, Pa., for which he is chemist, in order to place in position a new bell and to repair the arch of the gas flue leading to the boilers. The bricks forming the arch of this flue, from some cause unknown, had become disarranged to a great extent and were apparently ready to drop at any moment, so that it was found necessary to take down a portion of the furnace lining. The inner circle of fire brick in the upper portion of the furnace was protected by a cast iron casing, covering the exposed ends and under surfaces. At a distance of 8 feet from the furnace top, filling in between the iron casings above and the fire brick below, was found a large deposit of carbon. This deposit did not occur in isolated spots, but rather uniformly distributed throughout the layers as far as we had opportunity to observe; whether it extended to a greater depth, or the whole distance round the furnace, I am unable to say. The position of the deposit was on the front, or the side of the furnace receiving no blast, and almost directly underneath the gas flue. The courses of brick on this side of the furnace were distorted to a great extent and elevated several inches above those on the opposite side. Thus it seemed that the carbon had exerted a physical force, causing the displacement in the furnace lining and in the arch of the gas flue. No deposit was found beyond the inner circle of fire brick, as the iron casings only extended this far. When taken from its position the mass of carbon was seen to glow, a partial combustion taking place on the surface, converting the small particles of metallic iron or lower oxides distributed throughout the mass into the peroxide. This is readily seen on examining the lumps, where on the surface small particles of the peroxide of iron are noticed gradually decreasing as we go in and finally disappearing in the interior. The carbon was found principally in the form of a powder, but occasionally aggregated into lumps; it had a uniform black color, and when rubbed on the hands resembled powdered graphite. It absorbed water readily and was slightly attracted by the magnet. The total amount of metallic iron was determined in samples taken from different portions of the mass. Two samples of the fine portion taken from different places yielded, on analysis, 4·23 and 3·23 per cent of metallic iron. The interior of one of the lumps was also analyzed; the total amount of metallic iron it contained was 2·56 per cent; 0·35 of this existed as metallic iron, the remainder, 2·21 per cent, was combined as an oxide. The substance was free from cyanogen and chlorine. The cause of this formation was evidently due to the presence of the iron casings, as we do not find the deposit beyond the point where they extended. In the "Transactions" of the American Institute of Mining Engineers, vol. ii., Mr. Frank Firmstone called attention to a similar deposition of carbon in the blast furnace, but I do not know that the occurrence is usual. The cause of the deposition of the carbon in the furnace at the Crane Works was doubtless the iron casings, which, when partially oxidized, effected the decomposition of the carbonic oxide in the manner first pointed out by Bell, and subsequently investigated by Gruner.

NOTES OF PATENT OFFICE DECISIONS.

In the interference case of Blackman vs. Morray, the subject matter involved was a burial case, the entire top portion of which was formed of glass and the lower portion of cement, the two being joined by tongue-and-groove and cement joints, also flanges and bolts.

Evidently coffins having top and bottom sections, with tongue-and-groove interlock joints, the sections being made wholly of cement, terra-cotta, or glass, were old in the art. The patent of J. R. Cannon, of October 25, 1859, No. 25,883, was for a glass burial case in two parts, upper and lower, which were hermetically joined "by tongue-and-groove and cement joints, also by flanges and bolts." Mention may also be found in nearly every cyclopedia of coffins made of cement, baked clay, etc. Patents for constructing coffins from hydraulic cement were granted as early as 1835, and subsequently patents have been granted for cement coffins, coffins made of asphaltum composition, and for peculiar cements for coating and sealing coffins. David Sholl, March 25, 1855, was granted a patent for "a coffin composed of terra-cotta or pottery ware." Glass lids to coffins were also notoriously old.

It was insisted, however, that by the combination in interference, there had been united for the first time in a coffin the element of strength or indestructibility and the element of transparency—a non-breakable coffin capable of wear and transportation, and at the same time having a transparent lid. The commissioner, however, held that cement and glass employed in the combination in interference had been previously used for precisely the same purposes. Neither of these materials possessed even the merit of being put to a new use, but were simply employed in juxtaposition, and each performed precisely the same functions as before. The result, evidently, was not the product of the combination, but a "mere aggregate of several results, each the complete product of one of the combined elements." Given the desire to unite the elements of strength and transparency in a coffin in the manner claimed by the parties in interference, and the materials and method were at once found in that very art. Compared with what existed before, the alleged invention in interference consisted in simply selecting proper and well known materials for their proper and well known uses, without the least exercise of the inventive faculty. The interference was accordingly dissolved by the commissioner, and the application for a patent rejected.

In the interlocutory appeal from the decision of the primary examiner in the matter of the application of R. W. Hamilton, for "independent condensing mechanism for steam engines," the question at issue related to a division of the application. The examiner decided that each of the combinations separately claimed in this application should be the subject of a distinct application, on the ground that they were distinct inventions relating to well recognized classes.

Such questions are not easy to decide, as the Patent Office, on the one hand, should avoid imposing any hardship upon an applicant by requiring separate applications for what might be included in one, and, on the other hand, must avoid the confusion which would, in the present condition of the arts, necessarily result from indiscriminately including in one patent matters known and recognized as belonging to distinct classes. In an advanced state of the art subdivision becomes more and more necessary, and that which was before known only as a part of a machine may become a distinct subject matter of improvement not relating directly to the whole machine, but specifically confined to a part of the original machine, and applicable to that part, whether used in a machine of one class or another. If such matters are not kept within well defined limits of classification, it becomes impossible either for the Patent Office or the public to keep accurately advised as to the state of the art in any particular class. In the case under consideration the applicant stated that his invention related to an independent condensing mechanism which could be attached to and used in connection with any ordinary steam engine. His first claim was for—

"A combined air pump and condenser for steam engines, in which the air pump, constructed and arranged as set forth, is contained in the base of the condenser, and is operated by an independent steam cylinder."

The second claim was for—

"The water-packing space, Q, around the plunger of the air pump, in combination with the pipe, M, leading from the condensing chamber, or other equivalent device for supplying it with water."

M was the pipe to carry the water from the condenser to the water packing space; but under the phrase "other equivalent device," anything which would bring the water to the packing space might be included.

The examiner therefore held that this claim was for no more than the simple packing, applicable to pistons in various uses, and belonging to a distinct class of inventions, and this decision of the examiner was affirmed by the commissioner.

Amending the Patent Law.

One of the provisions of the bill pending in Congress to amend the patent laws is that, in a suit by a patentee, "the defendant shall not be charged with any savings he may have made if he shall show that the use of the patent has not enabled him to realize an actual profit in that part of the business connected with the use of the invention."

That is, if a man steals property, or takes it without the owner's permission, he shall not pay for the use of it unless he has made it profitable to his business. This is an illustration of the spirit of the parties who devised the bill. It is a principle of confiscation. Said a prominent superintendent and a member of the Western Railway Association, "When our attention is called to a patent of value we use it, and in a few cases we are made to pay by plucky inventors; but, in the aggregate, we pay much less than if we took licenses at first."

It is most extraordinary that this association is organized to such an extent on the principles which govern the bandit. Calling on the State and national governments with success to protect their property from the confiscation of strikers, the companies in this association turn round and adopt the principle of the strikers' organization, make organized war on the rights of inventors, and cause a bill to be introduced into Congress to help them in their confiscation.

If every feature of their wretched policy cannot be eliminated from the bill, it ought to be defeated. Some small politicians have introduced resolutions into conventions in deprecation of the rights of inventors. They belong to that destructive set of political economists which maintain that the gain of one man or community must be from the robbery of another. It is nearly extinct, but disciples of every absurdity occasionally reappear.—*Erie Morning Dispatch.*

Professor Henry's Successor.

The Board of Regents of the Smithsonian Institution has elected Professor Spencer Fullerton Baird as the successor of the late Professor Henry in his position of secretary to that institution. The new secretary is a member of the National Academy of Sciences, and has been for several years the Assistant Secretary of the Smithsonian Institution, and is perfectly familiar with all the plans and purposes of the late secretary for carrying out the designs of its founder. There was at the beginning considerable discussion as to the best means of conducting the institution so as to meet the wish of the founder, which was, according to the terms of his will, to create at Washington "an establishment for the increase and diffusion of knowledge among men." This Professor Henry understood to mean not merely the increase and diffusion of already existing knowledge, but that it would include the discovery and diffusion of new truths as well. There was some difference of opinion on this point, but Professor Henry's ideas finally prevailed, and the institution has been so conducted as to spread the knowledge obtained through its researches and the aid of its funds over the whole world, rather than to benefit Washington and its surroundings, or even the United States. This policy, it is believed, the new secretary will continue.

Professor Baird was born at Reading, Pa., in 1823, and is consequently fifty-five years of age and in the full vigor and prime of manhood. He is a well versed naturalist, and by talent and experience is eminently qualified for his new post of duty.

American Exports and the Strikers in England.

Consul General Badeau at London has sent to the Department of State a dispatch relating to the disastrous strikes of British operatives and the influence of the competition of American manufacturers in the markets of England. In the discussion between the cotton manufacturers of Lancashire and the weavers now on strike there, and in the comments of the press thereon, it is generally, although unwillingly, conceded that a potential influence has been exerted by American competition in diminishing the English cotton trade at home and abroad. England now sends to this country less than one third the quantity of goods she sent in 1860, while, on the other hand, it is stated that 30,000 pieces of cotton goods have been shipped weekly to England for two or three years from New York and Boston. Some say that these goods have been sold at a loss to realize cash, but this is denied by good authorities, who admit, however, that the profit is but small. The London *Times* attributes the increase of American manufactures at the cost of British industry to the superior quality and equal or cheaper prices of American cotton, besides general domestic advantages in process of manufacture. The *Saturday Review* declares that American products are profitably competing with British goods, not only in the Eastern markets but in England itself, and attributes the decline of the Eastern trade to the "fraudulent folly of English manufacturers, who have lost their customers by palming off on them adulterated goods," as well as to the fact that the American cotton manufacturers can produce at a less cost than the British. General Badeau advocates the policy on the part of American manufacturers of carefully maintaining the superior standard of their wares, and selling at low and comparatively unremunerative rates for a time, by which means, added to our natural advantages, a still greater share in the coveted trade, if not in England, certainly in China and Japan, may be diverted into American channels.

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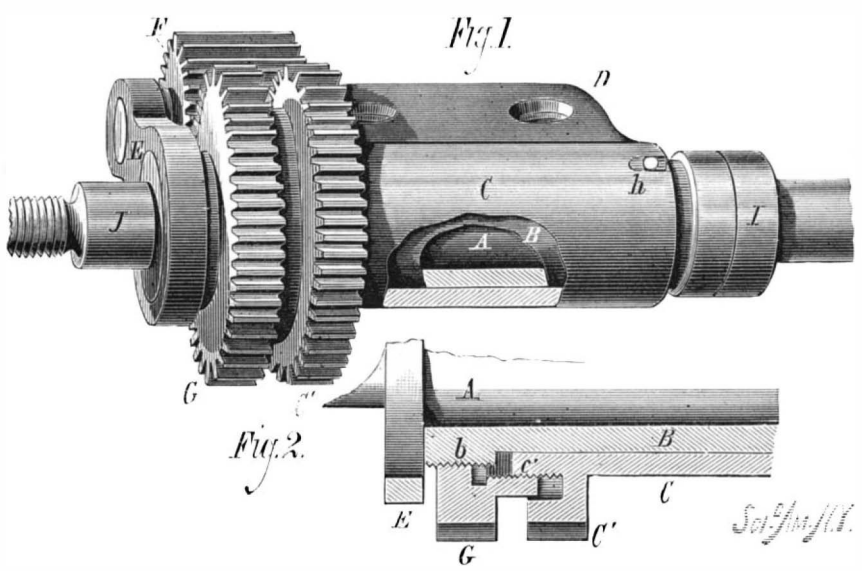
METHOD OF CORRECTING A LEADING SCREW.

BY JOSHUA ROSE, M.E.

It was recently required, when cutting a new screw at the Pratt & Whitney Company's works, to correct the error in the lead screw of the lathe in which the new one was to be cut. This was accomplished by employing the device shown in our engravings, and which was designed by Mr. A. Swasey. It was first ascertained by testing the lathe that its lead screw was too short by $\frac{7}{100}$ of a revolution in a length of 2 feet, the pitch of its thread being 6 to an inch. Now in 2 feet of the screw there would be 144 threads, and since $\frac{7}{100}$ (the part of a revolution the thread was too short) $\times \frac{1}{6}$ (the pitch of the thread) = $\frac{7}{600}$ (which was called $\frac{1}{85}$), the error amounted to $\frac{1}{85}$ inch in 144 turns of the screw The construction of the device employed to correct this error is as follows: In Figs. 1 and 2, A represents the bearing of the feed screw of the lathe, and B *b* a sleeve, a sliding fit upon A, prevented from revolving by the pin, *h*, while still having liberty to move endways. C represents a casing affording journal bearing to B *b*, having a fixed gear wheel at its end, *c'*, and an external thread upon a hub at that end. D is the flange of C to fasten the device to the shears of the latter, being held by screws. E represents an arm fast upon the collar of the feed screw, and carrying the pinion, F, the latter being in gear with the pinion, C', and also with G, which is a pinion containing two internal threads, one fitting to B at *b*, Fig. 2, and the other fitting to C at *c'*, Fig. 2, the former having a pitch of 27 threads to an inch, the latter a pitch of 25 to an inch.

The operation is as follows: The ordinary change wheels are connected to the feed screw, or lead screw, as it is sometimes termed, at J in the usual manner. The arm, E, being fast to the feed screw will revolve with it, and cause the pinion, F, to revolve around the stationary gear wheel, C'. F also gears with G. Now F is of 12 diametrical pitch and contains 26 teeth, C' is of 12 diametrical pitch and contains 37 teeth, and G is of 12 diametrical pitch and contains 36 teeth. It follows that the pinion, F, while moving around the fixed gear, C', will revolve the pinion, G (which acts as a nut), to an amount depending upon the difference in the number of its teeth and those of fixed gear, C' (in this case as 36 is to 37), and upon the difference in the pitches of the two threads, so that at each revolution G will move the feed screw ahead of the speed imparted by the change gears, the end of the sleeve, B, abutting against the collar, I, of the feed screw to move it forward.

In this case there are 36 turns of the feed screw, A, for one turn of the nut pinion, G, the thread on sleeve, B, being 27, and that on the hub of C being 25 to the inch; hence, 36 turns of the feed screw gives an end motion to the sleeve, B, of $\frac{1}{25}$ minus $\frac{1}{27}$ = $\frac{2}{675}$, and $\frac{1}{36}$ of that = $\frac{1}{1350}$ of an inch = the amount of sliding motion of the sleeve, *b*, for each revolution of the lathe feed screw. By varying the proportions between the number of teeth in C' and G and the pitches of the two threads in a proper and suitable ratio, the device enables the cutting of a true thread from any untrue one in which the variation is regular.



DEVICE FOR CORRECTING A LEADING SCREW.

About Sugar.

Strawberries contain 5·86 per cent of their weight of glucose, cherries 10, white currants 6·40, and hothouse grapes 18·37; pineapples, on the other hand, contain 11·33 per cent of cane sugar, apricots 6, and oranges 4. The sugar cane, when perfectly ripe, contains 18 per cent of sugar. The juice of the sugar beet contains about 14 per cent of sugar. In Havana we learn that there is one cane factory capable of producing 125 tons of sugar per diem. In many factories the use of blood is now entirely dispensed with, though great care is required in the management of the filtration.

FIREWORK MAKING.

This art is, if not really a secret one, very little known to the general public, owing to the danger attending the manufacture, which prevents casual visitors inquiring, and to the nature of the product, which offers no inducements to the analyst.

In calling special attention to pyrotechny as an art well worth cultivating, even although apparently an expensive luxury, we desire to laud the wondrous æsthetic effects of light and color, rather than the mere detonations calculated to impress the savage or the uncultured.

It is a matter of great regret that the results of the pyrotechnist's art are so evanescent, not even ephemeral, but almost instantly vanishing. The stately rocket and its comet-like tail of soft fire, the fiercely hissing gerb, the detonating bomb, and the fountains and myriad devices delighting with swift surprises in coruscation, steady glow, flashing, gleaming, and waning—all minister to our sense of the beautiful, and are well calculated to arouse and to maintain enthusiasm in the cause in which they are offered in honor.

It is our purpose to approach within the precincts, and analyze the modes by which all these effects are produced. It must be premised that the manufacture is dangerous to all concerned in it, principally from the liability to accidents caused by careless strangers. Hence it is secluded and shrouded in mystery. The operatives should be well separated by open space to prevent a petty accident causing a general disaster. There are few, if any, complicated or costly machines. Tables and vises, pans and sieves, paste-pots and twine, and a stove, compose the principal "plant."

Nearly all fireworks require paper cases—made of pasted strips rolled around a wooden mandrel. These cases are filled with "compositions" made of "meal powder" (that is, ungrained gunpowder) mixed with various ingredients.

In some "pieces" there is required "force;" in others, color. In the rocket force is most needed; in the Bengal light, color. Roman candles need force and color alternately. For all, the cases need to be light and strong, and it is desirable to have the powder burn as long as possible.

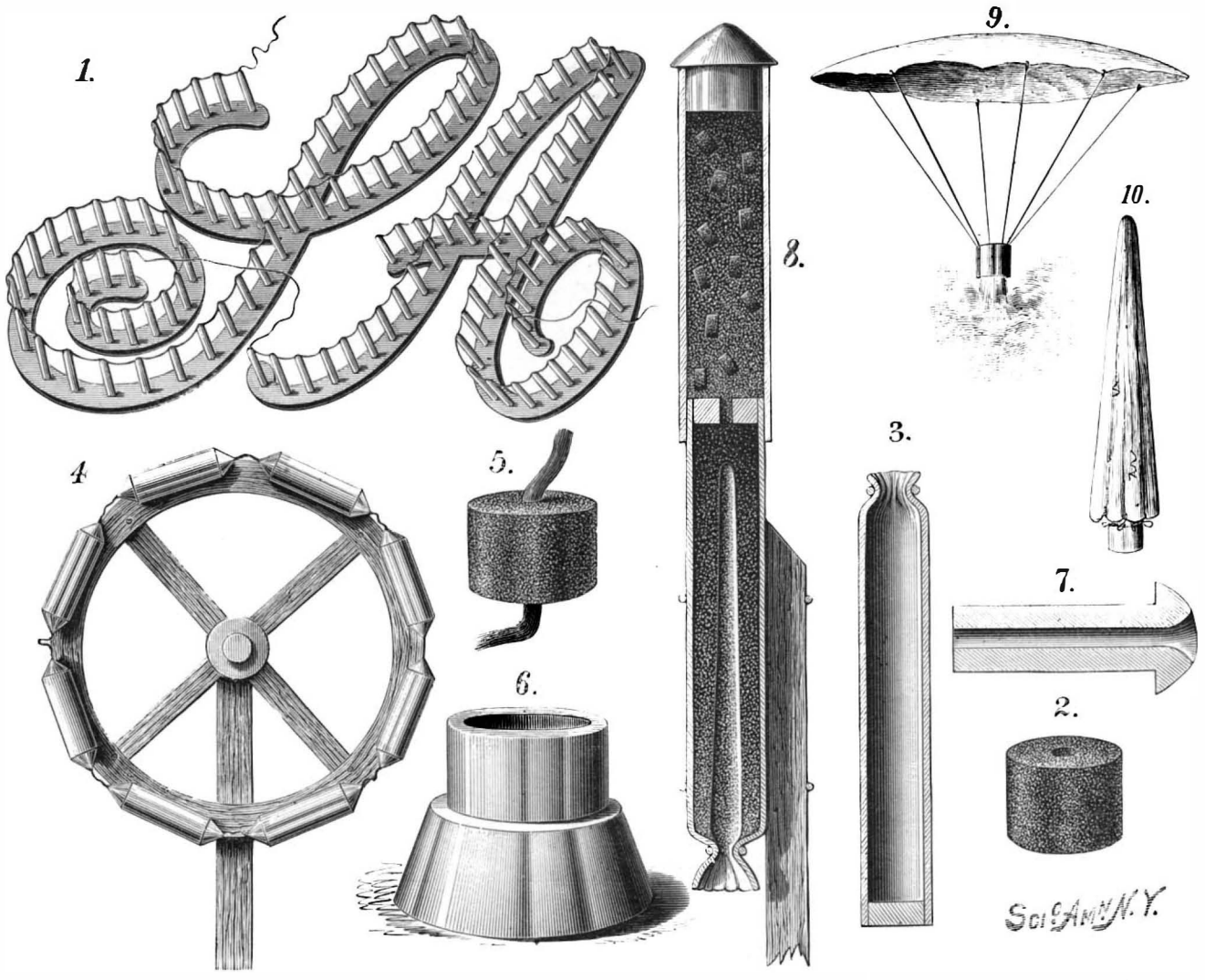
The meal powder is made of sulphur, niter, and charcoal. With this are mixed, according to the result desired, filings of cast and wrought iron, steel, copper, and zinc; dust of camphor, rosin, or lycopodium. To get the brightest red and white sparks, long iron filings free from rust are needed; for brilliant fire with radiations or coruscations, steel filings and cast iron borings. Green flames are given by copper; pale green, by verdigris; palm green, by blue vitriol (sulphate of copper) and by sal ammoniac. Blue is given by zinc; better blue, but with more smoke, by sulphuret of antimony. Yellow comes from amber or rosin, or dry salt. Lampblack makes gunpowder flame red, which an excess of niter tones down to pink. Camphor is used to give an intense white flame; also to give aromatic odors, as do benzoin and storax. Lycopodium gives magnificent rose-colored flames. Hundreds of formulas are given in Spon's "Workshop Recipes" and other works.

The simplest element in pyrotechny is the small paper case called a "lance," used by hundreds in "set pieces." Lance are quills or thin tubes (say 5 inches long) of about ¼ inch bore, and tightly rammed with a color composition. These are closely fixed perpendicularly to frames of desired outline, and their outer ends connected by a quick match so that all burn at once. They should burn about two minutes. The sketch, Fig. 1, shows how a "set piece" would be made.

The large Bengal light case should not burn; and is rammed with color composition. The Roman candle case is thicker and still stronger. It is packed with alternate layers of color, "stars," and projecting compound; the design being to burn with color, and then to shoot out a star which shall burn in the air while more color is burning at the case. The American star, Fig. 2, is a hard dry wad of coloring composition about half an inch each way, and pierced so as to burn inside and out. The English makers make their stars of short thin paper cases, open at each end; or if desired to be changeable, open at one end only, and rammed with two layers of color composition. The star rests on a layer of projecting powder, which sends it out and lights it at the same time.

The gerb, Fig. 3, is a thick strong case, packed with projecting composition. It is "choked" at one end, so as to give a smooth small outlet for the gases, and thus give them more force. Gerbs are fixed tangentially on a free wheel, Fig. 4, which their combustion causes to rotate. The "choke" is effected when the case is wet, by making one turn of a strong cord near the mouth, and pulling strongly.

The "bomb," which is a magnificent and effective sound and color piece, very expensive, is a hollow sphere of zinc or paper (made in halves and pasted together with muslin), filled with stars just like those for Roman candles and rockets, save that each has a fuse extending through it, Fig. 5. A small quantity of gunpowder among the stars causes the shell to burst and lights the scattering stars. The bomb is fired either from an iron mortar or off a "block," Fig. 6, which is a wooden breech on which a temporary paper barrel is put. There is a "dish" in the top, a little powder is laid in this, the bomb on this, the paper barrel slid over the bomb, and the charge fired. A



DETAILS OF FIREWORKS.

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time fuse, Fig. 7, page 373, in the shell, explodes it at the proper point in its flight. A 3 inch shell contains 48 stars; 6 inch, 432; 8 inch, 1,674; 10 inch, 3,150; 12 inch, about 5,000!

A rocket, Fig. 8, is at once a highly scientific device and a work of art. It must be light, strong, steady, and high soaring; and it is sometimes demanded that it explode and liberate stars, or a parachute with a pot of colored fire. The conical cap is of no use, being merely a commercial "finish." There is a hard, thick, well choked paper case, rammed tight with projectile composition, but having a central conical bore left, so that the composition burns along the whole length of this bore, and most freely toward the end of its flight. If it be intended to explode at the end, there is a compartment filled with explosive powder, and with stars if desired, a pierced clay wad separating this from the regular filling.

The "parachute," Figs. 9 and 10, is a muslin circle, having suspended from it a "fire-pot," which is lighted when the rocket explodes and the parachute is set free. The rocket stick is merely to balance and guide it. Rockets are used for throwing life lines to wrecks, and recently for carrying charges of gun cotton up into the air so as to explode over any locality where it is intended to give a warning. Some strong rockets can soar nearly a mile in height.

A tourbillion is a case filled with projectile compound, and having its lower and lighted end pierced with spirally inclined vent holes, which cause it to ascend and revolve.

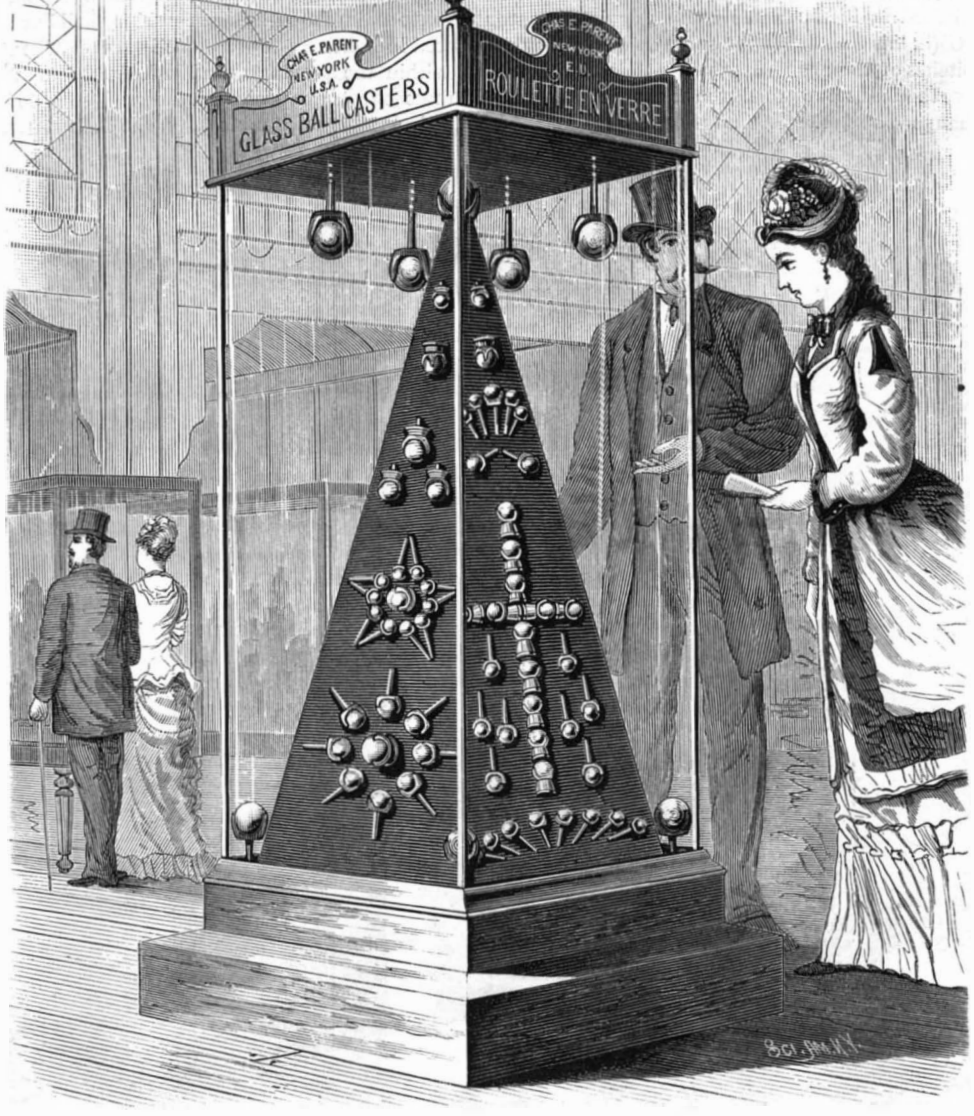
While at first thought a pyrotechnic display appears to be a very expensive luxury, it must be remembered that by no other means can an immense concourse be pleased, and that a display costing even $10,000, if witnessed by say 250,000 people, figures up to but four cents a head for two hours' varied and unceasing enjoyment.

THE GLASS BALL CASTER.

The illustration herewith presented represents the tasteful exhibit at the Paris Exposition of the Adgate Glass Ball Caster, an exceedingly ingenious contrivance which offers many advantages over the roller caster in common use. The construction of the device embodies little that is not seen at a glance. A glass ball, of size varied according to the weight of the article of furniture to be supported, is held in claws which are cast upon a shank, which last either slips into the leg of the piano or other object, or is attached to it by screws. The mode of attachment, in fact, is the same as with the ordinary caster. As of course the ball touches the inner sides of the claws only at points, at these places metal projections are provided, and directly under the shank is inserted a piece of bone, as shown in the small engraving. This reduces the friction between the ball and its holder.

The chief points of merit of this caster are its strength and remarkable ease of motion. When supported on roller casters a heavy piece of furniture when pushed usually moves in any direction but the one desired. With this caster the object is at once caused to travel as desired. The weight being placed directly above the ball, no leverage is exerted as in the case of the roller caster to twist off arms or break the shank. The ball being perfectly smooth leaves no mark on the softest carpet, nor can it become jammed so as not to roll. The friction between ball and carpet is thus very small and the wear of the latter reduced to almost nothing. For pianos, we are informed, this caster has proved especially suitable not merely in rendering them more easily handled, but, according to the testimony of Mr. S. B. Mills and other well known performers, it very greatly improves the tone of the instrument. Patented April 2, 1878.

For further particulars address the manufacturer, Mr. Charles E. Parent, 96 John street, New York city.



THE ADGATE GLASS BALL CASTER.

Firing Guns under Water.

Dr. H. A. Mott, of this city, has recently conducted a series of interesting experiments on the range of small arms when fired under water, his object being to determine whether this mode of testing could be used instead of the usual practice of firing the weapon in the air. He finds that the United States Army rifle is capable of projecting a bullet through water for a distance of 4 feet $1\frac{11}{16}$ inch, which corresponds to an air range of 3182·54 feet. The travel of a bullet one quarter inch under water is equivalent to a flight of 16 feet in the air.

Dr. Mott concludes that by this mode of investigation range and penetration can be arrived at with the greatest precision, and by the same means can be determined the value of the numerous gunpowders in the market in point of maximum and minimum effect, the best weight of bullet for a given weight of powder, and the best length of barrel and size of bore for a given weight of powder and bullet. All these observations can be carried on in a room less than 10 feet square. Dr. Mott's report of his investigation, with tables, etc., will be found in full in SCIENTIFIC AMERICAN SUPPLEMENT, No. 127.

Oleomargarine Under the Microscope.

Mr. Thomas Taylor, the microscopist of the Department of Agriculture, at Washington, has been examining under the microscope and comparing different specimens of butter obtained in the markets of that city, with the view of determining the difference between pure butter and that made from oleomargarine, or butter made by churning fat with

THE GLASS BALL CASTER.

cream. He finds that, when viewed under the microscope, pure dairy butter presents a uniform appearance as far as color is concerned. The forms seen consist of oil globules and the crystals of common salt. When viewed by polarized light very little change of color is observed; but when a specimen of oleomargarine is examined in the same manner, the field is speckled all over with shining particles which change color with every quarter turn of the analyzer, and Mr. Taylor has demonstrated that these glistening points consist of crystallized fat. In using a power of about 250 diameters, animal tissue is also seen more or less over the whole field, and a thin sheet of the fat placed under a power of about 75 diameters exhibits the polarized light beautifully, each solid fat cell showing all the colors of the rainbow; and on turning the analyzer or polarizer the changing complementary colors are exhibited. The process of grinding the fat by means of rollers destroys the solid crystalline cell contents; but the glistening appearance remains the same under polarized light, only subdivided, as a natural consequence.

One specimen of the oleomargarine butter examined by Mr. Taylor was highly charged with animal tissue and the urate of magnesia, the crystals of which were well defined, showing that the fat used in this case was impure and probably that of a diseased animal, which would seem to prove that the assertions made by the oleomargarine manufacturers as to the perfect purity of the fats used by them are not altogether correct.

From this it would appear that oleomargarine may be easily known from butter by the aid of the microscope, and that any impurities in the fats of which it is composed may be readily detected; and that it would pay large consumers of butter to microscopically examine their purchases so as to be certain of the quality or purity of the article they buy for butter.

THE INDUSTRIAL WEST.

With the oversupply of labor and capital in the East it is natural to look to the great teeming West for an outlet for the surplus labor and for the employment of capital in great enterprises and achievements. The "West," that is, the great basin east of the Rocky Mountains and west of the Alleghanies, holds a variety of resource and offers an opportunity for industrial employment not elsewhere found in the world.

Bound by ties of blood in a common brotherhood, connected by the iron pathways, and associated in trade and commerce, and political and social emulation, the East looks westward for her provisions and raw material, and for a market for her surplus and the employment of her overflow. How far is the world justified in its expectations of the West, and how much of hope is there of its industrial future?

The West has just felt the full force of the wave of disruption and disaster which followed the period of inflation succeeding the war. Not until within the past six months has the foreclosing of inevitable results fallen in its full effects upon the industries of the central western country. Some premonitions the West had from time to time in the disasters east of the Alleghanies, and the long shadows those troubles cast westward; but the disruption and disturbance of all fixed foundations and prospects have but come while the East is settling up old scores and reawakening to industrial prosperity. In the past six months the great iron works of the West have felt the force of the slackened demand for their products, and the heavy decline of the price of goods consequent upon the lower scale of manufacture and the almost bankrupt disposal of material. The great shops which are not idle are too nearly so to allow of profit, and to keep the plant in operation so as to avoid the loss of rust and waste in idleness is about the only effort. This is not the condition in a few instances, but in all the West beyond Pittsburg. The large shops at Chicago and vicinity, at Indianapolis, Cincinnati, and Cleveland, and especially at St. Louis, are idle or but partially in operation. In Chicago and St. Louis the suspension or winding up of more than half the banking institutions shows the pressure the country has had to meet.

Nor are the iron works the only ones. Every industry in the Mississippi basin has had its share of the disaster. That the wave of difficulty is over is more than probable, for there is no fuel upon which the element can feed; it has spent itself, and the tide of recuperation is slowly at work. The foundation upon which the future prosperity of the West is to be built is about all there is existing; but the foundation is firm, and the dear school of experience has been passed through, and the people have the knowledge and hold it worth all it so painfully cost.

What is to be the future of the West, and upon what basis of enterprise and achievement their prosperity is to be builded, can be only partially intimated. The first principle is the value to be derived from and the dependence to be placed upon her broad, unobstructed agricultural advantages. No other nation or locality has such resources and advantageous opportunities to begin with, and we are satisfied that the leaven of scientific cultivation now slowly working is soon to produce astonishing results in the great West. Not one half the fertile land of Ohio, Indiana, and Illinois is yet under cultivation, while but half the returns from the soil are received of which the land is capable. More labor will soon be given to ten acres than one hundred now receive, and the profits will be proportionately high.

Next after the agriculture the mineral resources of the West will yet be scientifically developed, and that to a proportionate profit. All other things upon the earth and in and under it are for the service of the farmer's pursuit, and in no part of the world is it so apparent as in the central Western States. No people can have more than they produce, and we are satisfied that no part of the world will take more interest or more pride in the development of their home resources to their utmost than the West. We are satisfied, too, that the central West is to be the great inland industrial empire of the world.

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THE PRAIRIE DOG AND ITS UNINVITED GUESTS.

The prairie dog (*Cynomys ludovicianus*) of the Missouri region, and westward and southward, belongs to a genus of American rodents intermediate between the marmots and prairie squirrels. This woodchuck in miniature is about 13 inches long, with the tail 4 inches more; the color above is reddish or cinnamon brown, with lighter tips to the hairs, and a few black ones intermixed; beneath, brownish-white or yellow; tail like the back, with a black tip. The cheek pouches are very rudimentary, the eyes large, and the ears very short. The prairie dog was probably so named from the sharp tone of its chattering, somewhat resembling the yelp of a small dog, as it bears no external resemblance whatever to the dog. It is the *petit chien* of the French Canadians, and the *wish-ton-wish* of the Western Indian.

These interesting animals live in burrows, and great numbers are found in the same locality, forming communities which the hunters call "dog towns." These villages often extend over a distance of several miles.

Before the entrance to each burrow there is a little conical mound of earth, heaped up to a height of about 18 inches, and, on the top of this, one of the occupants may usually be seen sitting, intent on watching what is going on in the community, or on the lookout for intruders. At the first alarm caused by an intruder, a general scampering takes place throughout the village, with cries of warning. Upon reaching their mounds they sit perfectly quiet, like so many sentinels, curious to know what all the commotion is about. At a further alarm they approach still closer to their entrances, ready to dive in, and appear to make vehement threats, throwing up their tails in a very comical manner with each energetic bark, accompanying this noisy chattering with a liquid gurgling sound. In a twinkling they disappear into their burrows in a ludicrous, tumbling manner, and then, after a short time, they may be seen here and there peeping out to see if the coast is clear. Like young pups, they are very clumsy in their movements, and when (as rarely occurs) they are surprised at a distance from their burrows and find they cannot escape, they assume an air of audacity, and a most singular expression of defiance or of impotent anger, before allowing themselves to be captured.

They feed chiefly at night, their food consisting almost exclusively of grass and succulent stems. In the fertile lands of Central Kansas, they sometimes prove terrible pests to the farmers in the sad havoc they make among the fields of growing corn.

Squirrel-like, they are prudent enough to lay up a full supply of provender to last them through the long and rigorous winters they often have to endure. It is said that late in summer one may frequently meet with burrows around the entrance of which, for some distance, the grass has been neatly mown and left to cure; and that, a few days later, the hay will be found to have been cleanly gathered up and carried into the burrow.

One of the most curious things in regard to the domestic economy of this little animal is that of its strange companionship with such undesirable guests as the burrowing owl and the rattlesnake, both of which are usually found inhabiting its abode. As to the owl, it is there like other parasites, perhaps, on sufferance merely, and very little notice is taken of its presence by the dog. Yet that the presence of the intruder is not always agreeable is proved by the fact that the dog often rids himself of the nuisance by removing his own quarters to a new burrow.

There are few birds that present a more ludicrous appearance than these same burrowing owls. They spend most of their time during the day standing at the entrance of their dwellings, apparently engaged in deep contemplation. When an intruder makes his appearance, they begin a series of most ridiculous and comical bowings and courtesies, staring all the while with their great solemn eyes; and then, with a cry somewhat like the sound of a watchman's rattle, they fly to a neighboring mound and resume the same air of pensive meditation. In the majority of cases, these owls are found in communities by themselves, in the deserted villages of the prairie dogs, their presence in many cases having served to drive the rightful proprietors from their dwellings.

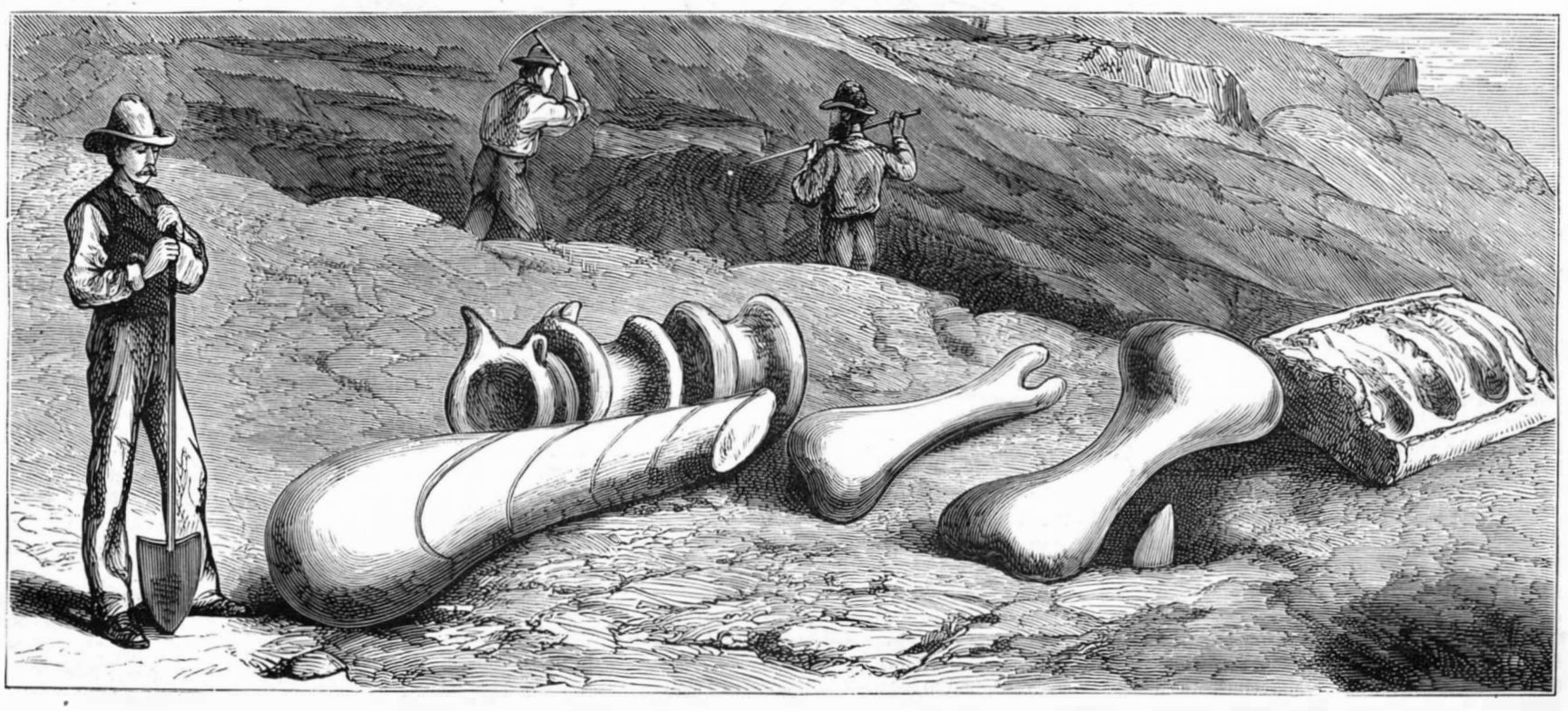
With regard to the rattlesnake, nothing of a satisfactory nature is known as to the part he plays in the domestic arrangements of this interesting community. Mr. Kendall, in his narrative of the Santa Fé Expedition, says that the prairie dogs are "compelled to let them pass in and out without molestation." Certain it is that, although the relations of the snake with both the dog and the owl are not all friendly, they are not so inimical as would naturally be imagined. The rattlesnake seems never to be wanton; it simply defends itself from danger, or procures its food by means of its terrible fangs. This food occasionally consists of the young of the prairie dog, but probably very seldom of the full grown animal or of the owl. Small animals do not usually show much fear of these reptiles when thrown together with them, and the prairie dog will unconcernedly pass them by and enter his burrow as they lie basking in the sun at its very entrance.

Prairie dogs readily become accustomed to the haunts of man, and their villages are often found on the outskirts of populous towns. They prefer, as locations for their villages, gently sloping lands skirting valleys, yet they are often found in the tops of the highest divides, and far down near the streams, though always avoiding rocky, marshy, or even moist grounds.

PRAIRIE DOG, RATTLESNAKE, AND OWL.

REMAINS OF GIGANTIC ANTEDILUVIANS.

The accompanying illustration represents some very important discoveries of gigantic fossils, which were unearthed last year in the Rocky Mountains, near Morrison, Bear Creek, Colorado, by the Rev. Arthur Lakes, Professor of Geology at Jarvis Hall, Colorado. The interest of these discoveries lies in the fact that they have been found in strata pronounced by professional geologists to be barren of vertebrate fossils. Some of these remains have been reached by blasting in the hard sandstone, and others have been dug out of a bed of soft clay lying beneath the rock, and these latter are very perfect and of monstrous size. Thus some twenty-five colossal vertebra average from 11 to 15 inches in diameter, and one mass of vertebræ, consisting of three vertebræ ossified together, measures nearly 3 feet square. Close by its side, as represented in the sketch, is another long bone, 3 feet 10 inches long and 22 inches at the butt end, possibly a scapula; but by far the most enormous bone is a portion of a femur, or thigh bone, measuring five feet in length, 28 by 12 inches in diameter, and the shaft 14 inches wide by 8 inches thick, weighing 600 lbs. Lying on the ground, like the pillar of some ancient temple, nothing can impress the observer more than this bone with the magni-



ANTEDILUVIAN REMAINS DISCOVERED IN THE ROCKY MOUNTAINS.

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tude of the animal to which it belonged—this being only a portion of a bone which, when complete, is presumed to have been 7½ to 8 feet long, and formed part of a leg fully 12 feet in length. These remains have been pronounced by Professor Marsh of Yale College to belong to the cretaceous period, and to be those of a new and gigantic species of *Dinosaur*—the largest ever discovered, and the largest known land animal; he names it *Titanosaurus montanus*, and estimates the creature, when alive, to have been fully sixty feet long, and when standing erect on its hind legs, after the custom of *Dinosaurs*, to feed on the foliage of the mountain forests, to have been eighty-five feet high.

With the *Titanosaurus* were found other *Dinosaurs*, one not larger than a cat (*Nanosaurus*), also the remains of a turtle, an almost perfect crocodile's head, with teeth, and several procælian vertebræ. Of these Professor Marsh says, in his address before the American Association, at Nashville, Tenn.: "The beds of the Rocky Mountain Wealden have just provided us with a genuine 'missing link'—a saurian *Diplosaurus*, with essentially the skull and teeth of a modern crocodile, and the vertebræ of its predecessor from the Trias. This peculiar reptile clearly represents an important stage in the progressive series, and evidently one soon after the separation of the crocodile branch from the main stem."

The sketch (made on the spot by a correspondent of the London *Graphic*) on page 375 represents the bones after they had been freed from their rocky surroundings, before being packed and forwarded to the Yale Museum. These excavations have been carried on by Professor Lakes since March of last year, with all the eager interest of a Layard disinterring Nineveh, or of a Schliemann exhuming Troy.

COOKING BY SOLAR HEAT.

To the Editor of the Scientific American:

I send you a short account of my experiments, made in Bombay, on the utilization of solar heat for cooking. The accompanying engraving will give an idea of the principle of the cooking apparatus. It consists of a conical reflector, A, made of wood and lined with common silvered sheet glass. Inside there is placed a copper cylindrical vessel, B, covered by a glass cover, C. The cooking vessel is raised about four inches from the bottom, and the glass cover is five inches longer than the vessel, and two inches wider, which leaves an interval of four inches of hot air under the boiler and one inch all round and at the top. The wedge under the apparatus is to keep it inclined, so that the rays of the sun may fall perpendicularly on the boiler. Glass being diathermanous to the direct or reflected rays of the sun, and non-diathermanous to obscure heat, the rays penetrate the glass, and, striking on the vessel, become transformed into obscure heat, when they are retained by the glass. The glass cover over the boiler is made octagonal, because, in that form, common window glass can be used. Of course a glass dome, such as is used for covering clocks or statuettes, would be better, and, equally, of course, a copper reflector electroplated with silver would be better than my reflector; but both of these articles are made octagonal in order that cheap material may be employed. The position of the apparatus requires to be changed about every half hour, to face the sun in its apparent course from east to west. The rations of seven soldiers, consisting of meat and vegetables, are thoroughly cooked by it in two hours, in January, the coldest month of the year in Bombay, and the men declare the food to be cooked much better than in the ordinary manner. Several people in Bombay and in the Deccan have tried it, and always with success. If the steam be retained the dish is a stew or a boil; if it be allowed to escape the food is baked. The reflector is two feet four inches in diameter. The intensity of the heat is increased by increasing the diameter of the reflector. One advantage of this apparatus is that the food will keep hot for a long time after the apparatus has been withdrawn from the solar rays. I withdrew it at 4 P. M., brought it into a room, and threw a railway rug over it. At 8 P. M., when it was uncovered, the metal vessel was too hot to be handled by the bare hand. I have a letter from a Surgeon General in the service, which informs me that he cooked a leg of mutton in it, and that it "kept hot for four hours" after having been removed from the air.

I am getting one made six feet in diameter, which will differ from that represented in the engraving by consisting of fourteen flat glasses instead of eight, and by having an angle of 45° until it is on a level with the middle of the vessel, and thence upward an angle of about 60°, by which arrangement the whole of the rays reflected from the silvered glass will fall on the lower half. Besides cooking food, I am making a series of experiments for heating steam boilers by concentrating the rays of the sun upon them.

For this purpose I use a combination of flat mirrors, of common sheet glass, silvered, fixed in rectangular frames so as to concentrate the solar rays to a focus at a distance of 20 feet. The focus is about 2 feet in diameter. The plan is on the same principle as that of Archimedes, by which he burned the Roman fleet, which, under Marcellus, was blockading Syracuse—the same plan as that suggested by Anthemius of Tralles in the problems by which he proved the exploit of Archimedes to be possible; and as that suggested by Kircher, and in 1747 adopted by Buffon. With 72 pieces of silvered sheet glass, each 15x10½ inches, at midday, in the month of May, a focus was formed, at a distance of 20 feet, of a temperature above 1,088° Fah. I arrived at that estimate as follows: 18 glasses raised the mercury in the thermometer to 360°; 36 glasses raised it to over 644°, when the mercury entered into ebullition, and consequently any further rise could not be registered. The ebullition of the mercury was very violent. Placing the temperature produced by the 36

LATHE FOR TURNING SPHERES.

glasses at 644°, the boiling point of mercury, and deducting 100° as the initial temperature of the atmosphere (the thermometer was in the shade), there remain 544° produced by 36 glasses. The focus from the remaining 36 glasses was then added, making 72 glasses; and I think it may be inferred that the temperature was then above 1,088°. Every kind of wood placed in this focus was instantly ignited, without being, as in Buffon's experiment, previously smeared with tar and shreds of wool. A solid cylinder of water, 18x8 inches, contained in a vertical copper vessel, provided with a steam pipe, was then placed in the focus, and it boiled in exactly 20 minutes. The ebullition was exceedingly violent. In January last I made another experiment with 198 glasses, each 15x10½ inches, fixed in 10 rectangular frames. A copper boiler containing 9 gallons of cold water was placed in the focus at 9:25 A.M. It commenced to boil in exactly 30 minutes. It was allowed to boil for exactly 1 hour, and at 10:55 the focus was turned off, when 3¾ gallons of water were found to have been evaporated.

My next experiment will be made with about 500 of these glasses, fixed in 20 rectangular frames, each 6 feet by about 4 feet. The focus will be about 2 feet in diameter, and (according to the calculation made on the basis of the results of the experiment with 72 glasses) the temperature will be over 7,616° Fah. The objects of that experiment will be to ascertain how soon after sunrise the water can be provoked to boil, the pressure that can be obtained in a given period, and the quantity of water that can be vaporized in a given time. Other experiments will be made, such as exposing different metals to the focus, etc. The boiler that will be used on that occasion is a vertical boiler, 2 feet 7 inches high and 16 inches in diameter, with an annular cylinder of water 3 inches in diameter up to half its height. It is made of beaten copper, ¼ inch thick, which will stand any pressure that can be produced in a boiler of those dimensions. It is provided with a steam pipe, a steam gauge, and a safety valve, and with no other fittings. The 20 frames will stand in two rows of 10 each, the second row on a platform 6 feet 6 inches high, forming a segment of a circle of 40 feet in diameter.

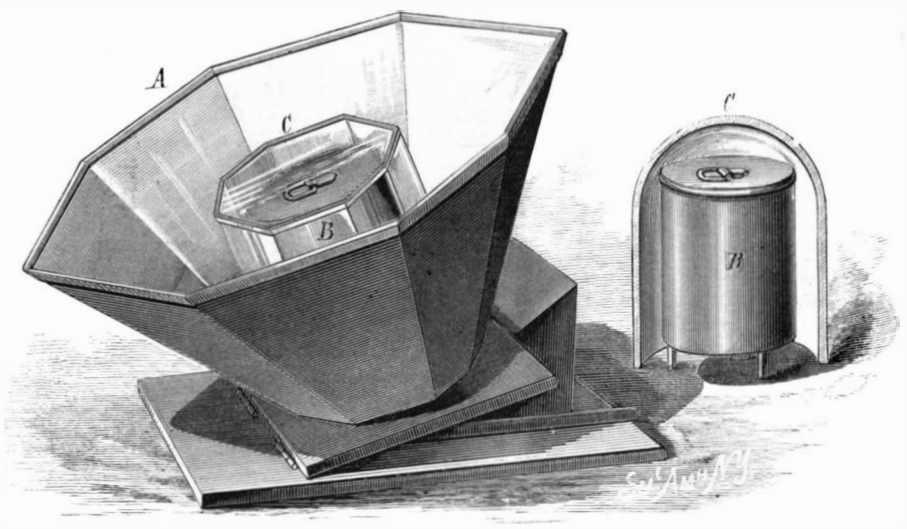
As there is no limit whatever to the number of these mirrors that can be used at once, there is none to the intensity of heat that can be produced, and consequently no limit to the force of the steam that can be generated. The cost of the reflecting material is next to nothing, and it is almost everlasting. There is no mechanical difficulty in keeping the focus on the boiler from soon after sunrise to a little before sunset.

I am aware of the force of the objection that the solar rays are sometimes intercepted by clouds, even in India; but as an auxiliary to the ordinary boilers, I believe that solar heat could be used so as to save at least 25 per cent of coal throughout the year by my plan. As coal in the seaports of India is never under 30 shillings per ton, and double that rate in the interior, such a saving would be exceedingly important. There are many other purposes to which it could be applied besides driving steam machinery or cooking food, such as distilling and rectifying spirits, etc. At Aden, for example, the sun always shines, and potable water is only obtained by distilling it from salt water.

I shall be very glad to have any expression from your readers upon the subject, especially upon the result of the experiment that I have described.

W. ADAMS.

Bombay, India.



ADAMS' SOLAR COOKING APPARATUS.

PRODUCING ACCURATE SPHERES.

An ingenious method of grinding perfect spheres was first proposed by the late Mr. H. Guy. It is especially applicable to hard materials, such as steel, glass, etc. Its principle is based on the fact that the section of a true sphere at any part is always a circle. In its application to the tools shown in the accompanying illustrations, the balls are first turned in the ordinary manner as correctly as possible, and a trifle larger than the required finished size. Mr. Guy's apparatus consists of two beechwood disks (A, Fig. 1), face to face, and attached to two lathe spindles and headstocks, B. The distance of these disks from each other is capable of nice adjustment by a screw or other suitable arrangement. On the spindles may be keyed two equal pulleys, C, over which a band passes from the power, crossed on one and open on the other; thus the two disks are driven in opposite directions with equal velocities. For a sphere of 1 in. diameter, Mr. Guy recommended disks of 10 in. diameter, and making about 400 revolutions per minute.

Mr. Wm. Granger, in a communication to the *English Mechanic*, proposes a modification of the apparatus, shown in Fig. 2, in which a more uniform motion is obtained by using small toothed wheels, and three bevel wheels to reverse the direction. The grinder is shown in Fig. 3, and is made of a piece of flat copper or brass with a conical hole through it, large enough to allow about one fourth of the sphere to project on the small side. The thickness of the grinder may be about ¼ in. diameter of the spheres, and the hole should be reamed to an angle of about 25°. It is important that the amount of bearing surface in the grinder should be narrow; about 1-16 inch for a 1 inch sphere is quite sufficient.

The rough sphere and the grinder are placed between the revolving disks, the former being tightly gripped between them; oil and emery powder are supplied to the grinder, and holding the latter in the hand, the ball should be made to traverse uniformly all around the disks, as in Fig. 4. Care should be taken to prevent the ball from stopping between the disks, as this would grind facets upon it. As the operation proceeds, finer emery must be used, and the sphere tried from time to time in a ring gauge of the required size. For precise work the finishing is done with disks covered with buff leather, and crocus is used instead of emery. The grinders must frequently be trued up with the reamer, as they soon wear out of shape.

Portrait of Prof. Henry.

WE are indebted to F. Gutekunst, the well-known photographer, 712 Arch Street, Philadelphia, Pa., for a fine photographic likeness of the late Professor Joseph Henry. It is one of the last, and we are not sure but it is the very last one for which this distinguished scientist sat.

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ORGANOGRAPHY, OR VEGETABLE ANATOMY.

Muscles are the chief instruments of voluntary motion in men and animals, and popular comprehension has hardly recognized, as yet, the fact of plant organization being an exact analogue to that of human beings. This has been generally supposed to be merely a speculation or theory among the learned or imaginative, and plants considered as rooted or fixed to one place, while the question of movement has been overlooked simply because plants do not rove about. It cannot be denied that the power to move may be exercised in different modes and directions, while the instruments may be essentially identical. In the human body movement is perpetual, and by no means limited to the act of walking. Life itself is movement, and the contrary, in figurative speech, is always understood to be an equivalent for death.

The flux and reflux of currents in the growth and development of plant life are continual, and readily admitted by the most superficial observer; but the instruments or organs by which spontaneous movements are made are not ordinarily admitted as even existing. Muscular contraction is to be found in those fibers of the footstalks of leaves, which act in closing their upper surfaces together, or bending them downward; within the claws of petals, and divisions of the calyx, when exerted for the purpose of opening or closing the corollas or calyxes of the florescence. They act also as resistants to external irritation or internal sensations of discomfort in the plant individual, making efforts to prevent or remove sensations which annoy, or to encourage those which are necessary and agreeable. They act under the stimulus of light, turning the upper side of the leaf to the point most favorable for receiving that stimulus. The Abbé Tessier ("Hist. de l'Académie Royal, ann. 1783") exposed a variety of plants, in a cavern, to different quantities of light, and demonstrated satisfactorily that the contraction or elongation of muscular action in plants, or, in other words, their elasticity, was sensibly affected by the presence or absence of light.

Instances of muscular dilatation and contraction abound, and to the observant eye are very evident. To quote from an Italian writer: "If the top of the floret (chondrilla) be touched (which has five stamens surrounding one pistil), all the filaments which support the cylindrical anther will contract themselves, and, by raising or depressing the anther, the whole pollen will be collected on the stigma; and if one filament be touched after it is separated from the floret, it will be found to contract like the muscular fibers of animal bodies."

Plants are known to change the direction of their roots or trunks, as, for instance, where a plant has been inverted intentionally, or placed root uppermost, the root makes an effort to curve downward, and the stem upward, until it regains its natural and proper direction. Acted upon by the air, sun, and light, the muscles direct the upward course of the stems; and acted upon by the moist warm vapors in the ground, they also determine the direction of the roots. While in some species the muscles are robust and powerful, in others they are extremely delicate and minute, but none the less fitted to be instruments for fulfilling the will of the individual plant, the same as the muscles of a man obey the mandates of his active brain.

A plant named *Upata* or *Sanar* is found in Senegal, with roots which rise vertically a foot above the surface of the earth. With the aid of their muscular fibers plants are enabled to forsake a poor soil and reach a better one. They frequently succeed in reaching to newly formed ditches and canals, where they can obtain a more abundant supply of moisture. Roots and branches are known to surmount almost insuperable obstacles in order to gain their end, that is, to supply their necessities. A branch has been known to leave its normal direction parallel to the soil, and to overtop an obstruction, with the evident purpose of attaining a more favorable exposure to the sun, air, and light. Roots penetrate into hard soils, through stone walls, and even into rocks by bursting them. By means of muscular elasticity numerous flowers leave their perpendicular direction, and, with the purpose of exposing their faces to the sun, follow his diurnal course by looking towards the east in the morning, the south at noon, and the west at evening. Moisture and dryness are both necessary conditions for the action of muscular fiber. The existence of these fibers was incontrovertibly established by the observations of La Hirè, Hales, and Bonnet.

Change of direction is conspicuous in the altered aspect of plants at night, and under excess of moisture, particularly evident in compound or pinnated leaves. The winged leaves of the leguminous tribe, acted upon by the heat of the sun, rise vertically and form a right angle with the common footstalk, the lobes or lesser leaves clinging together by their upper surface. Simple leaves, as in Indian mallow (*Urena*), when exposed to the sun, become concave. Winged leaves, in a close, moist, and cloudy atmosphere, may be found extended along the common footstalk; and after the sun sets, they hang vertically downward, closed together by the lower surface, like the leaves of a book. If there is an odd lobe at the extremity, it folds upon itself until it reaches the first pair of leaves in its neighborhood. The simple leaves of bastard and fever-few are good examples. In trefoil, lucerne, and lotus they unite by their extremities, and form a cavity of protection from the chill of the night season. According to M. Duhamel, this muscular motion is, in sensitive

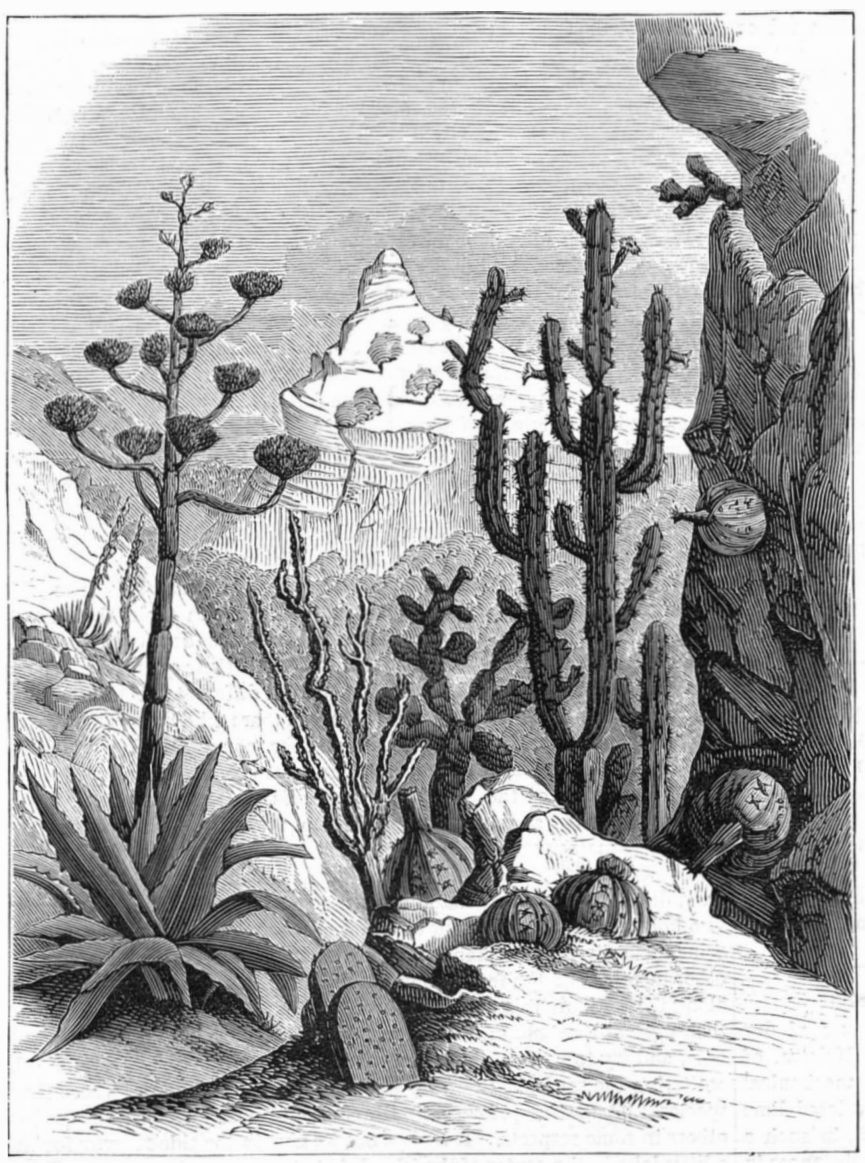
VENUS'S FLY TRAP.

plants, evinced in the two forms of natural and artificial; warm vapors causing the one, and external agencies, such as touching or shaking, causing the other. The muscular motion of the sensitive plants is laid open to our inspection, and is an instance of extreme contractile force. At the lightest touch of the hand they move, close their leaves, and bend their branches, until a sympathetic agitation extends throughout a whole savanna; a sight which charmed and astonished the Spaniards who penetrated the American Isthmus in 1548, who gave them the expressive appellation of *dormideras*.

The sensitive plant of Senegal, called by the negroes *guerikar*, or "good day," has been frequently described. When it is touched, or even bowed to, it inclines its stem and turns its leaves as though in polite response to a salutation. The *Dionœa muscipula* (Venus's fly trap) is another familiar instance, to be found in marshy soils in North America. The leaves are massed in rosettes around the floral stem, and spread out upon the soil. These have at their extremities a sort of reddish appendage, hollowed into two large lobes, attached to the main leaf by the mid vein only. The edges of these foliated lobes are garnished with hairs, and their surface bristles with little points, constantly covered with a viscous liquor which attracts insects, particularly flies, which are dissolved by matter secreted in the plant, or, as we might with propriety suggest, digested, and affording nutrition to the plant. As the fly struggles, the leaves contract, and the insect is either suffocated or bled to death upon the bristling points of the leaf.

The true sensitive plants of South America are described by M. de Martius in his "Travels in Brazil," as closing their leaves by an agitated muscular movement when even a horse galloped over distant ground, and equally startled by the approaching step of a man. The animation of an extended group of these sensitives in that tropical climate must carry with it to the mind of the beholder a curious sensation of awakened conviction in regard to the intensity of animation, which is less prominent, though, as we believe, no less actual in the vegetable lives of colder climates. The burning sun and luxuriant growths of Brazil, for instance, reveal a movement and an expression, which, seen for the first time, convey a freshness of conception which equals an added power of vision, and is not readily forgotten, but ever after colors all conceptions in regard to vegetable beings, as organized harmoniously, with complete organs for the execution of equally complete functions.

R. C. K.



AGAVE, CACTUS, AND MELOCACTUS.

MEXICAN FLORA.

Our engraving shows some of the prominent types of the flora of the hotter and drier portions of Mexico. At the left is an agave, a genus of the order *Amaryllidaceæ*, or American aloes, the common species of which is known in Mexico as *mescal*. From its sap, obtained by incisions in the stem, a fermented liquor, called *pulque*, is made, which, when distilled, forms the *vino mescal*, or common cactus brandy. It is a popular error that the plants or trees belonging to this genus require a century to arrive at maturity, when the flower is put forth, to remain dormant, so far as efflorescence is concerned, for another full century. In hot climates, otherwise favorable to development, maturity is reached sometimes in ten years; but in colder countries a much longer period is required, thus affording some justification for the popular belief.

Several varieties of cactus are also shown in the engraving. In the foreground are specimens of the *C. opuntia*, or prickly pear, and of the *C. melocactus*, the great melon thistle or "Turk's cap," as it is sometimes called, one of the most remarkable members of the family. The large cactus in the background is the *C. cochinillifer*, which forms the chief nourishment of the cochineal insect.

New Inventions.

Mr. N. Overfield, of Rockaway Beach, N.Y., has contrived a Portable Bathing House made of canvas stretched on a frame so constructed as to be readily taken down and adjusted in compact form for removal or storage. The arrangement for ventilation is efficient.

Mr. H. D. Cress, of Cromwell, Ind., has invented a simple Draught Equalizer, consisting of a draught bar, to the ends of which the outer traces are hooked, the inner traces connecting with a chain which passes over a pulley carried by a plate secured to the middle of the draught bar. The whole is securely braced.

Mr. A. Dittrich, of St. Luke's, England, has patented a spring-acted Umbrella Tip Cup, capable of being readily applied to the umbrella stick, and without requiring detachment of any portion of the frame.

An improved Heating Stove, invented by Mr. F. J. Gould, of Sidney, Ohio, is of the double magazine, base-burning type, and is intended for burning soft coal. In the old styles of double magazine stoves the gas generated in the inner magazine had no other escape but the top of the stove, so as to vitiate the air; this is prevented by an arrangement of draught holes of the outer magazine. Other advantages are claimed.

Mr. G. W. Gomber, of Hazleton, Pa., has patented an improved Bottle Stopper, which is operated on the same general plan as the De Quillfeldt stopper, but made compound, with a different hanging of the eccentric lever, and with new details intended to give increased durability.

A convenient Clasp for Pocket Books, patented by Mr. Louis Prahar, of New York city, is so constructed that it may be put together after being plated, without danger of marring the plating, and which, it is claimed, cannot be detached accidentally.

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Mr. N. Fox, of Savannah, Ga., has patented an improved Bottle Stopper, especially for effervescent liquids, which permits the bottle to be closed before removal from the filling machine. The principal parts are a collar, secured to the bottle neck, a cap which screws down upon the collar, operating a ball valve, and a suitable nozzle.

Mr. G. W. Everett, of New York city, has patented a Skirt Holder for drygoods stores, etc., which may be conveniently folded into a narrow space for being packed in a trunk or otherwise stored away.

An improved Clothes Pin, patented by Messrs. H. L. Clark and A. B. Smith, of Chester, N. Y., is formed by the combination, with a straight-shanked hook having a thumb piece and stop, of a spiral spring and follower, the latter having two fingers which engage with the hook.

An improved Child's Carriage, invented by Mr. C. Gillis, of Brooklyn, N. Y., has a flexible body, like a hammock, and the frame is so arranged as to fold into a small compass for carrying upstairs, or may be readily taken to pieces for transportation.

A new Harness Pad, recently patented, is claimed to rest easily upon the horse's back and not press upon the spine. The tree is a flat bar of wrought iron having end loops for receiving the trace-supporting traps, and having ears on each edge for receiving the pad-fastening screws; and the pads are wooden blocks covered with several thicknesses of cloth or felt and leather. The inventor is Mr. L. W. Vandenburg, of Honesdale, Pa.

Mr. Henry Holcomb, of Painesville, Ohio, has invented an improved Hot Air Furnace, which is provided with automatic means for regulating the admission of cold air into the fire chamber, and which embodies a number of novel details.

An amusing Mechanical Toy, recently patented, may be said to convey a moral. It is called "the careless engineer," and illustrates by a harmless clockwork explosion the danger attending an engineer's carelessness. It may also be set so as to run without accident, showing the safety which results from proper care. This is the idea of Mr. Stacy Potts, of Philadelphia, Pa.

An improved Knife Scourer, patented by Mr. N. A. Wierman, of Bendersville, Pa., is claimed to be made much more durable than is usual by making the scouring rubbers detachable, so as to present a fresh face from time to time, and by applying the pressure at the middle of the rubbers, at the point where the most wear occurs, so as to hold them to their work even when considerably worn.

A new Fire Escape, patented by Messrs. John Swank and Arnold Jehnke, of Denver, Colo., is of the class in which the downward motion of the person is checked by means of a friction clutch attached to the drum carrying the rope by which the descent is made. It has, in addition to a spring acted clutch, a further safeguard in the shape of a brake operated by a nut, to be used in case the clutch proves insufficient.

An improved Rocking Chair of the class having a stationary base and spring connected rocking seat, which has lately become so popular, has been invented by Mr. M. Schrenkeisen, of New York city. The interposition of rubber blocks prevents jar as the chair reaches the end of its forward or backward movement, and there are other improvements.

Mr. E. T. Rogers, of New York city, has invented a Filter intended for the feed water of steam engine boilers and similar uses. It has a vertical breakwater plate and one or more vertical screens at the inlet end, and similar vertical screens at the outlet end, with a central charcoal chamber, and under it a sediment receptacle.

Mr. John Conrath, of Salamanca, N. Y., has patented an apparatus for Drying and Stretching Curtains, arranged to keep the curtain under tension by its own weight while drying, and capable of being compactly folded when not in use.

A Lock for Stovepipe Joints, designed to keep the lengths from coming apart and the line of pipe from sagging, has been patented by Mr. J. W. Woolsey, of Henderson, Minn. A metallic strip riveted to one length passes through a slit in a corresponding strip attached to the other length, and is bent upon itself, forming a secure tie.

Messrs. N. N. Sprecher and I. B. Keller, of Reading, Pa., have patented an improvement in Shirt Scales, which is claimed to provide a convenient and reliable rule for graduating slopes required between different diameters of neck measurement in all sizes and proportions.

Mr. F. J. Grotevent, of Reading, Pa., has patented a convenient Mailing Package for transporting small quantities of powdered substances as samples. It is a box having a hinged lid at each end, and contained by a paper wrapper and a cloth wrapper, both of which are wrapped permanently around the box, folded over upon the lids at the ends of the box, and held in place by cord, which may be easily unfastened.

An improved Dumping Wagon, the invention of Mr. J. H. Nelson, of Wayne, Wis., has a box made in four sections, either of which may be emptied independently. By this construction the load may be discharged in four separate heaps.

Manufacture of Chloride of Lime.

A new process for the expeditious manufacture of dry chloride of lime has been invented by Mr. E. Maletra, of Paris, which consists in the employment of mechanical means for stirring, agitating, or mixing the powdered lime and the chloride of lime as fast as it is formed, in such a manner as to expose all the molecules of these substances in succession to the continuous action of the gaseous chlorine, which is introduced under favorable conditions for combining with the lime, and is rapidly absorbed by the latter. In order to insure regularity, it has been found necessary to couple at least two apparatus together, so as to admit of the chlorine being directed into either, as required. The process is very rapid, and is carried out with great facility, and without any waste of chlorine. The progress of the operation may be constantly watched by persons near the apparatus, which emits no injurious odors. The apparatus is cheap in construction, and occupies but small space. The manufacture may be regulated at will, as examples of absolute homogeneity (as may be ascertained by testing) may be taken at any time during the operation. As the chloride of lime manufactured in this manner is homogeneous in every part, it is not liable to become decomposed, as is the case with chlorides manufactured in layers, more or less deep, and in a state of rest, and a source of considerable loss is thereby avoided in the manufacture of this product, which is liable to deterioration from the influence of climate and other influences resulting from its composition.

Natural History Notes.

Leaf Veins of Poison Hemlock.—Some interesting remarks on the leaf of the poison hemlock (*Conium maculatum*) formed the substance of a paper recently read before the Linnæan Society by Mr. J. Gorham. From his observations it was shown that in a piece of the leaf, one third of an inch long by one fifth wide, the veinlets were arranged exactly in the same way as the venation of the entire leaf. This was also found to occur in the other umbelliferous plants that were examined, so that it was possible to detect and recognize each from the merest fragment. This is something like describing an animal from a bone. These facts open a new field to the student of botany, besides promising to be of valuable service in medico-legal investigation. The relation of the venation of leaves to the branches of a tree may yield more interesting facts on investigation.

Habits of the Fur Bearing Seal.—At a recent meeting of the Linnæan Society there were exhibited mounted specimens of the fur bearing seal of the Pacific, male, female, and young. Mention was made of the "rookeries" of these animals, containing over three million seals in a compact area. Like old Turks, a male dominates over a harem of a dozen or fifteen females, which he guards with jealous care, for two months or more never stirring from the spot, and meantime fights terrific battles for its maintenance. A neutral zone exists to the rear of the breeding grounds, where the enforced bachelors and adolescent young of both sexes repair. These come and go continuously, passing to and fro through free lanes of passage. Others of these creatures delight in dashing among the breakers on the surf, or frolic and play in droves on the sand and grassy dunes adjoining the more rocky ground of the "rookery." In preparing the skins of these seals for commerce, the under side is shaved in such a manner that the roots of the long, coarse hairs are cut loose and the hairs set free, so that nothing is retained but their fine fur.

A Rare Bird at Central Park.—There is at present on exhibition at the Central Park menagerie, for a short time only, while in transit for Europe, a very rare specimen of a bird belonging to the family *Megapodiidæ* (so named because of their large feet). This is the first specimen ever brought alive to this country, and will be the first living example ever seen in Europe, should it arrive there safely. It is a native of one of the East Indies—Nina-Fou or Proby Island, which is situated about half way between the Feejee and Samoan Islands. The bird is of a uniform blackish-brown color, cheeks and upper part of neck vermilion red, slightly feathered with small black plumes, bill bright yellow, tarsi and toes pale yellow, claws black; length from bill to end of tail about 14 inches. There are about twenty species belonging to this family of megapods. They are found chiefly in the tropics, and inhabit dense forests and swamps, generally in the vicinity of the sea beach. These birds are remarkable for the extraordinary contrivances resorted to by them to obtain the artificial heat necessary to hatch their eggs. For this purpose some of them form mounds, and are hence called "mound builders." These mounds, which sometimes reach fourteen feet in height, with a circumference of 150 feet, are composed partly of vegetable matter, which the birds bring by small quantities at a time in their large feet. In the middle of these mounds, at various depths (from 18 inches to several feet) the females deposit their eggs, some in the form of a circle, while others of a different species place them irregularly. When the eggs are all deposited, the center is entirely covered in, and the mound raised several feet in the form of a cone. The heat produced by the fermentation of the vegetable matter is then retained within the mass, and brings the eggs to maturity. The birds are usually engaged in laying their eggs during a period of from two to three months. The Celebean megapod has a different method of hatching its eggs: it places them in a hole which it has dug out of a rotten stump; then, covering them up with vegetable matter, leaves them. Again, other members of the family burrow obliquely into the sand along the seashore to a depth of three or four feet, deposit their eggs at the bottom, then cover up the mouth of the hole, and try to conceal their foot-marks leading thereto by scattering the sand about. The habits of the Central Park species (*Megapodius pritchardii*) differ from those of the others in some respects. It scoops out its nest in the side of a little lake in the center of the island, between one and two feet in depth, laying about forty eggs in the months of September and October. The exact period of incubation is unknown. The most remarkable thing about these birds is that, after all the trouble and care taken for the preservation of their eggs, they should be so utterly indifferent to the fate of their young, leaving them to scratch their way out of whatever position the eggs were placed in, and to take care of themselves afterwards.

The American Oyster.—It is a well known fact that the edible oyster (*Ostrea edulis*) attains its full growth and proper flavor only in the waters of the American coast; and that its representative in Great Britain, owing perhaps to some trouble in its "environments," has dwindled down to a minute coppery-flavored bivalve, which affords to the evolutionist a melancholy example of "reversion," and to the American gastronome an object of aversion. It is no wonder, then, that when one of our American oysters is seen for the first time by an inhabitant of the British Isles, it should call forth expressions of great surprise. An English gentleman who has been indulging in some of our exported "Blue Points," writes to the "Notes and Queries" column of a recent number of *Land and Water*, asking for information in regard to these "delicious mollusks." He says:

"As an old correspondent, I want to know, in common with many of your readers, who have asked me the question, what are Blue Point oysters? Now, perhaps my friend Mr. Buckland, who has done so much for and written so well on these delicious mollusks, will enlighten us. Tempted by the advertisement in *Land and Water*, I sent to the offices of the New Direct Supply and Trading Association, Cannon street, for a bag of fifty for only 4s., including a knife. I found them excellent, notwithstanding the extraordinary shape of some of the shells, which I send with this. One of them you will see is like the Irishman's gun, which, being bent, he said was made to shoot around the corners; but the contents of this were very fine, large, and plump, as indeed all were, more or less; the contents of the smallest shells were frequently larger than those contained in the more pretentious. I wish to direct your attention to the large black spot in the middle of the flat shells of all of them; they are now slightly fading, but when first opened were quite black. I should like to know if this color has anything to do with the flavor, for I found the blue points so good that I have had three, and am now going to order another basket. They are reported to come from America. When Mr. Buckland returns from his official tour in Cornwall, perhaps he will tell us something about them, or Major Iles Home, the obliging manager of the Stores, will enlighten us, saying how long the season lasts for eating them."

An Imprisoned Owl.—The Lancaster (Pa.) *Examiner* says: "The owner of a large farm, not far from Lancaster, had an opportunity a few days ago of witnessing how an interloper is punished by the martin species of birds. A pair of martins had taken possession of a small box, and were building their nest. One day, while they were absent, a screech owl took possession of the box, and when the martins came home at night would not allow them to enter. The smaller birds were nonplussed for a while, and in a short time flew away, seemingly giving up the fight. But if the owl was of this opinion he was sadly mistaken, for in a short time the little ones returned, bringing with them a whole army of their companions, who immediately set to work, and, procuring mud, plastered the entrance to the box shut. They then all flew away. In a few days the box was examined and the owl was found dead."

Solid-hoofed Pigs.—Dr. Coues states that a breed of solid-hoofed pigs has apparently been established in Texas. The terminal phalanges of the toes are united to form a single broad phalanx; above this, however, the other two phalanges remain perfectly distinct. The hoof is perfectly solid, and on its sole there is a broad angular elevation of horny substance, which is curiously like the frog of the horse's hoof. The breed is so firmly established that no tendency to revert to the original and normal form is observable. It is further stated that, in the cross of a solid-hoofed boar with a sow of the ordinary type, a majority of the litter have the peculiarity of the male parent.

African Explorations.

The United States Consul at St. Paul de Loando reports to the Department of State that the German exploring expedition sent out under the leadership of Herr Otto Schmitt by the Geographical Society of Berlin, and which recently left Loando for the purpose of making accurate surveys east of Quango and south of the Congo, had safely reached Melange, about 200 miles south of Loando, where heavy rains had delayed them. When these rains are over, the expedition will again resume its march. Much valuable work had already been accomplished, and a number of maps of actual surveys had been made, of which copies will be sent to our government.

In this connection it may be stated that the United States Commercial Agent at Gaboon informs the Department of State that more missionaries are following in the path of Stanley's discoveries, two having recently spent a few days at Gaboon *en route* for the Congo, who had been sent out by philanthropic merchants at London and Liverpool, to ascend the south bank of the river to a point above the first rapids, where they are to establish an industrial Christian mission. This and similar enterprises, the agent thinks, will pave the way for the extension of commerce and steam navigation upon the vast interior rivers of Ethiopia and the development of her valuable resources.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Patent Lawyers, Experts, and Capitalists wanted to collect $1,000,000 for infringements, at 50 per cent. Most valuable patent ever issued. Address 2,049 Euclid Ave., Cleveland, Ohio.

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Vises, horizontal and vertical, illustrated on page 342. Sample sent prepaid in the U.S. on receipt of $2. Patent for sale. W.X.Stevens, East Brookfield, Mass.

Cash Registering Machine required in every store. Patent rights for sale. Circulars, Box 619, Petrolia, Pa.

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Wanted.—A New or Second-hand Jeweler's Hand Power Drop, in good order. Address, with price, D. M. Williams & Co., Fort Worth, Texas.

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Vertical & Yacht Engines. N.W.Twiss, New Haven, Ct.

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Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

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Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

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F. Lunkenheimer's Brass Goods for Engine Builders, Automatic Oil Feeders, Glass Oil Cups, Cody Shaft Oilers, etc. Address Cincinnati Brass Works.

The SCIENTIFIC AMERICAN Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the SCIENTIFIC AMERICAN, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

1,000 2d hand machines for sale Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Cheap but Good. The "Roberts Engine," see cut in this paper, June 1st, 1878. Alse horizontal and vertical engines and boilers. E. E. Roberts, 107 Liberty St., N. Y.

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For Shafting, Pulleys, Hangers, etc., send for price list and discount to Hilles & Jones, Wilmington, Del.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

Valuable Invention to users of Steam Boilers. See advt., page 318, last issue. Address U S. Automatic Stoker Co., No. 2 Chestnut St., Philadelphia, Pa.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St. Wm. Sellers & Co.

The great Wheelock Engine, which furnishes the power to the machinery of the American Exhibit at the Paris Exposition this year, is lubricated by Patent Lubricene and Cups. Our exhibit will equal that which we made in Philadelphia in 1876. R. J. Chard, 134 M. Lane, N. Y. city.

Friction Clutches for heavy work. Can be run at high speeds, and start gradual. Safety Elevators and Hoisting Machinery a specialty. D. Frisbie & Co., New Haven, Ct.

Wrenches.—The Lipsey "Reliable" is strongest and best. Six inch sample by mail 60 cents. Roper Caloric Engine Manufacturing Co., 91 Washington St., N. Y.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See ad. back page.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

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We make steel castings from ¼ to 10,000 lbs. weight. 3 times as strong as cast iron. 12,000 Crank Shafts of this steel now running and proved superior to wrought iron. Circulars and price list free. Address Chester Steel Castings Co., Evelina St., Philadelphia, Pa.

Blake's Belt Studs, the best fastening for Rubber and Leather Belts. Greene, Tweed & Co., 18 Park Place, N.Y

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., U.S.A.

The Turbine Wheel made by Risdon & Co., Mt. Holly, N. J., gave the best results at Centennial test.

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Bound Volumes of the Scientific American.—I have on hand bound volumes of the Scientific American, which I will sell (singly or together) at $1 each, to be sent by express. See advertisement on page 380. John Edwards, P. O. Box 786, N. Y.

NEW BOOKS AND PUBLICATIONS.

PRINCIPLES OF MACHINE CONSTRUCTION. By Edward Tomkins. With volume of Plates. G. P. Putnam's Sons, Publishers, 182 Fifth avenue, New York.

This work belongs to Putnam's Advanced Science series. It is an exceedingly clear, well arranged and well edited treatise, simple enough for the student of mechanical engineering at the outset, and at the same time it will prove a useful manual of reference to the practicing engineer. We cancommend the book as one which embodies a great deal of information which too often by the free use of the higher mathematics is made unnecessarily obscure. No extensive knowledge on the part of the reader is here presupposed. The author begins with simple drawing apparatus, and devotes his initial chapter to the rudiments of draughting. He then advances through various geometrical constructions, development of surfaces, etc., and finally in the chapter on "Motion" enters upon the application of the principles laid down. Elementary combinations of mechanism, a discussion of materials, modes of construction, a good clear exposition of the difficult subject of gearing, and lastly the practical building of machine tools, make up the rest of a volume which impresses us as excellent from beginning to end.

PINE PLANTATIONS ON THE SAND WASTES OF FRANCE. By John Croumbie Brown, LL.D. Edinburgh: Oliver & Boyd, Publishers.

Dr. Brown has published a number of valuable work on sylviculture, which contain strong arguments against the destruction of forests and in favor of reclaiming waste lands by tree planting. The present work relates mainly to the attempts at arresting and utilizing the sand drifts on the waste regions in France by the plantation of the pine and other trees or grass, the suitability of which is indicated by the nature of the soil and atmospheric conditions.

A MANUAL OF INDUSTRIAL CHEMISTRY. Edited by B. H. Paul, Ph.D. New York: John Wiley & Sons, 15 Astor Place. Price $10.

This work is based upon a translation of Stohmann and Engler's German edition of Payen's "Précis de Chimie Industrielle." It is copiously illustrated, and the editor has added some chapters on the chemistry of the metals. As a manual for general reference it will probably serve instead of larger and more costly works, as it contains much useful information in condensed form.

PROTECTION AND REVENUE IN 1877. Published by G. P. Putnam's Sons, 182 Fifth avenue, New York.

This is a lecture delivered before the New York Free Trade Club by Professor Sumner of Yale College. It adds many cogent arguments to one side of a controversy in which it is not the province of this journal to participate.

Notes & Queries

(1) G. W. S. asks: Can any saving be made in battery material of Callaud cells by breaking circuit when not needed for use? A. If the circuit remains open any length of time the blue (copper) solution reaches the zinc; soluble zinc sulphate is then formed and the copper deposited on the zinc. The Smee or Leclanché cell is better suited for open circuit lines.

(2) C. B. P. asks: 1. What is the title of M. Peclet's work, so often quoted in Rankine's treatise on the steam engine? A. "Traité de Chaleur," par M. Peclet, Paris. 2. Who are the standard authorities on locomotive engineering? A. Colburn, Clark, Holley, and Forney are authors of standard treatises on the locomotive. 3. Does an engineer, who makes a specialty of locomotives, require to be well versed in the higher branches of mathematics, such as calculus, trigonometry, or conic sections? A. Some of the most successful builders have been ignorant of the higher analysis, but such knowledge is frequently of great assistance.

(3) O. J. B. asks: Which will transmit more power, a polished cast iron pulley or a rough one? A. A polished pulley.

(4) W. M. J. writes: I wish to build a 16 x 25 foot drying room for green lumber 25 feet from my engine, using the exhaust steam from the engine, which is 25 horse power. It takes all the power to do the work required of it with a free exhaust through a 2½ inch pipe. I am fearful of the back pressure. Will it do to enlarge the pipe ½ inch, and if so, how many coils of pipe will be necessary? A. You can regulate the back pressure to a considerable degree by using large heating pipes. With 3 inch pipe and 8 or 9 coils, which would probably be sufficient for your purpose, the back pressure ought not to be increased more than from 1½ to 2 lbs. per square inch.

(5) G. & H. ask how to galvanize sheet iron. A. The iron should be cleaned by immersion in an acid bath (sulphuric acid and water, equal parts), and then scrubbed with sand or emery. When clean, it is to be placed in a bath of melted zinc, covered with sal ammoniac. If desired, it may then be placed in a bath of melted tin, or may be used at once, after receiving the zinc coating.

(6) R. J. B. writes: Occasionally I am in the habit of laying my pen, without cleaning, on the writing desk (which is of mahogany) and by so doing have spotted the desk in many places. What will remove the stains? A. The ink may be removed by the application of strong aqueous solution of oxalic acid or a solution of calcium hypochlorite in acetic acid. Apply wet blot ing paper to remove excess of solution, and then a dry blotter. After the wood is dry apply a little boiled oil. The spotting cannot be altogether obliterated.

(7) G. S. C. writes: By using oxalic acid with Prussian blue for laundry purposes, it gives the water a greenish tinge. What can I use that will give the water a purplish tinge or a purplish blue? A. Use potassium ferrocyanide instead of oxalic acid, in proportion of about 3 to 20 of the Berlin blue. See p. 969, SCIENTIFIC AMERICAN SUPPLEMENT, No. 61.

(8) E. B. asks whether spur or bevel wheel gearing is preferable, in cases where either kind can be applied. A. Spur gearing is best.

(9) W. & K. write: We have difficulty with a belt in our office. On which will a leather belt slip least, smooth iron, rough iron, or a turned wood surface? A. Smooth iron. As a general rule the best way to prevent the slipping of belts on smooth faced pulleys, is to increase the area of the friction surface by using pulleys of larger diameter or width of face, and belts of a corresponding size.

(10) J. F. N. asks: Will a tin tube answer as a core upon which to wind an induction coil for electrical purposes; would the tin cause any diminution of the current? A. It is not advisable to use the tin tube for the core; it is better to wind the primary coil directly on a core or bundle of parallel iron wires, covered with one or two layers of clean paper soaked in paraffin.

(11) G. M. W. asks: What volume of steam, at atmospheric pressure, is procurable from the evaporation of a unit volume of water, and what would be the ratio of decrease in the volume of steam under added pressure? A. According to Professor Rankine, whose calculations agree quite well with the experimental investigations of Fairbairn and Tate, the relative volume of steam, compared with that of water, is as follows:

Pressure in Atmospheres.	Relative Volume.
1	1646
2	850
3	580
4	440

(12) C. W. M. asks: 1. How can rusty steel tools be made bright? A. Clean them with oiled emery paper. 2. How can a soldering iron be tinned when the tin is off, so that the solder will adhere to the iron? A. Heat the soldering iron, and file the end down to the clear copper, then rub it in resin and solder mixed by the heat of the iron. You may have to file the iron twice.

(13) F. L. M. asks: 1. In what kind of water will most likely be found animalcules for low powermicroscopes from 20 to 100 diameters? A. Any stagnant water. 2. How can I obtain some "paste eels?" A. Allow flour paste to stand two weeks or more in a moderately warm place, in contact with the air. 3. What power is required to distinguish human from other blood? A. Not less than 500 diameters; one fifth inch objective with B eyepiece. It is questioned by some microscopists whether the distinction is always possible.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

H. A. J.—It is hornblende.—W. M. B.—The fire clay is not of excellent quality. It is of little value as a pigment. Properly tempered it might serve as material for drain pipes, tiles, common pottery, soft bricks, etc.—J. N., Jr.—The glittering particles in the powder are of mica. Not valuable.—A. B. T.—The sandstone and red jasper contain nothing of value.—J. S., M.D. We do not consider the pebble of value; it is milky quartz.—C. & R.—The sample of quartz does not appear to be auriferous. The other specimen contains silica, clay (aluminum silicate), lime, magnesia, and a little sodium and iron.—E. A. S.—The samples of native magnesium sulphate received. We should be pleased to have further particulars respecting the deposit.—E. McD.—The samples consist principally of lime carbonate with a little sulphate and a trace of potassa, strontium, and phosphoric acid.—D. E.—It is a fair quality of fire clay.—J. D.—Nos. 1, 2, and 3 are argillaceous limestones. Nos. 4 and 5 contain calcium carbonate with a little baryta and strontia. No. 6 is calcareous clay. No. 7 is clay slate. No. 8 is a variety of hematite. No. 9 is a concretionary formation of cal careous clay. We cannot judge from the specimens of the proximity of coal. No. 1 might be used as a building stone, but is rather soft.—W. J. C.—It is zinc blende—of some value as a source of zinc.—W. J. T.—The curious hair-like substance formed on the coke is similar to the mineral wool now largely made from molten blast furnace slag by the contact with a jet of hot air or steam. In composition it is an iron-lime-alumina silicate, containing a little graphitic carbon. Its formation would require an unusually high temperature in the retort.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Singular Locomotive Accident. By W. J. T.
The Jury at the Paris Exhibition.
Storm and Flood Signals. By A. W.
Set ing Boilers. By F. B. C.
Money. By J. A.
Iron Mining and Manufactures. By M. I. H.
The Phonautograph.
Ink Wipers. By C. F. S.
Price of Machinery. By J. C. H.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 23, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Amalgamator, S. F. Charles	202,703
Amalgamator, Firmin & Forster	202,804
Animals, shelter for, W. Heaton	202,648
Auger, earth, O. H. Polley	202,864
Axle, car, H. Watkeys	202,682
Baby walker, J. H. Headler	202,724
Balance, spring, C. Forschner	202,807
Bale tie, Gray & Johnson	202,719
Balloon, W. F. Pearson	202,750
Barrel lining, M. Lafiin	202,834
Basin waste pipe, I. A. Singer	202,762
Bathing house, portable, N. Overfield	202,748
Bed, camp, O. A. White	202,685
Bedstead, table, A. A. Hoffman	202,823
Bell, horse car, J. M. Gaughen	202,645
Bobbin, shuttle, R. W. Porter	202,664
Boiler, steam, B. T. Babbitt	202,689
Boilers, fire box for steam, G. H. Hoagland	202,819
Book binding, J. S. Lever (r)	8,195
Book rack, J. M. Clark	202,790
Boot and shoe, T. Poore	202,865
Boot and shoe heels, S. T. Gates	202,808
Bottle stopper, N. Fox	202,714
Bottle washing machine, C. Michel	202,740
Brake shoe for railway cars, R. N. Allen	202,772
Brick machine, Phillips & Williams	202,861
Buckle, J. B. Gathright	202,644
Bullion, covering strands for, R. C. Alton	202,774
Burglar alarm, G. W. Eddy	202,798
Burglar alarm, C. H. Carter	202,630
Burial case, L. K. Dutton	202,797
Button, C. B. Chaffee	202,789
Button, West & Spittle	202,634
Button, E. S. & J. E. Wheeler	202,907
Cans for holding oil, Collins & Boughton	202,791
Car, stock, J. Miller	202,854
Card, advertising, G. C. Bell	202,692
Carriage, child's, C. Gillis	202,715
Carriage tops, etc., fastener for, J. Watters	202,683
Cartridge box, J. W. Frazier	202,642
Cartridges, capping, H. A. Kingsland	202,831
Chair, nursery, F. Caulier	202,788
Check book, G. E. Waring, Jr. (r)	8,199
Cigar machine, R. A. Bright, Jr	202,628
Clock, H. J. & W. D. Davies	202,795
Clock, V. Himmer (r)	8,194
Clothes line tightener, S. Conner	202,684
Clothes pounder, M P. Colvin	202,792
Cock, gauge, C. J. Elliott	202,659
Cock, water, M. Hogan	202,653
Cocoa nut fiber, treatment of, E. Pallu	202,662
Coin, detecting counterfeit, Baker & Simonton	202,691
Coin package, C. F. Trout	202,893
Colors, ultramarine, R. Hoffman	202,822
Cotton gin saw cleaner, R. S. Munger	202,744
Cultivator, J. Smith	202,763
Cupboard, elevating, J. T. Westwood	202,906
Curry comb, Lawrence & Holmes	202,897
Curtain cord tightener, J. F. Mienhardt	202,852
Curtain roller rack, J. F. Almy	202,773
Cutlery, table, C. Reese	202,757
Ditching machine, T. F. McGough	202,661
Dog power, F. K. Traxler	202,679
Door chain, T. F. Stevenson	202,885
Draught equalizer, H. D. Cress	202,705
Effervescent liquids, drawing, T. Warker (r)	8,200
Election stickers, blank for, J. Arnold	202,775
Engine, W. H. Hoffman	202,821
Engine, C. M. & E. E. Miller	202,853
Engine, W. H. Elliot	202,638
Engine, F. Starkenberg	202,882
Engine, O. Stenberg	202,884
Engine, B. H. Taylor	202,888
Engine, D. Turner	202,894
Engine condenser, W. J. Allen (r)	8,188
Engine condenser, J. Absterdam (r)	8,193
Envelope, O. P. Hatfield	202,816
Fabrics, machine for cutting, A. Warth	202,900, 202,901
Faucet, bung, S. T. Moore	202,855
Felting process, Flagg & Jackson	202,805
Fence, W. M. Landreth	202,836
Fence, C. H. Phelps	202,752
Fence, N. Westcott	202,905
Fence, W. R. White	202,636
Fence, H. & J. Harrington	202,722
Fence post, E. D. Roseman	202,875
Fiber, machine for making, L. P. Summers	202,766
Fiber, treatment of waste, J. Wilkins	202,910
File, bill, T. Lees	202,732
Filtering apparatus, A. Van Haagen (r)	8,192
Fire alarm, signal box, R. N. Tooker	202,891
Fire arm, W. H. Bliss	202,627
Fire arm, L. Ybarra	202,915
Fire escape, F. Dettmer	202,708
Fire escape, Swank & Jehnke	202,767
Fire front, J. A. Ewing	202,799
Fishing apparatus, O. Hesse	202,818
Fluting device, J. & E. Shane & Hooker	202,669
Fluting iron, N. R. Streeter	202,676
Fruit drier, H. Brown	202,699
Fuel box, W. McCarroll	202,842
Funnel, D. B. Lester	202,734
Furnace, boiler, J. Jenks	202,657
Furnace, metallurgic, T. D. Morgan	202,743
Furnace, reverberating, W. Mann	202,845
Furnace, smoke consuming, A. Gross	202,646
Furnace fire lining and back, O. Earnshaw	202,637
Furnaces, gas check for blast, D. N. Jones	202,730
Garlic separator, Shamberger & Carroll	202,761
Gas lighting burner, A. L. Bogart	202,694
Gate, B. B. Huntington	202,728
Glass, annealing, H. Gerike	202,809
Glassware, machine for finishing, D. Challinor	202,631
Glassware, ornamenting, A. Harcum	202,647
Governor, E. Towns	202,892
Grain band, G. A. Brackett	202,697
Grain bin, J. A. Wolfley	202,911
Grain binder, N. B. Fassett	202,803
Grain binder, Olmsted, Travis & Chute	202,747
Grain separator, J. M., F. W. & C. V. Herman	202,721
Grain separator, M. H. Pitts	202,863
Grinding machine, A. E. Elmer	202,640
Grinding machine, J. Hunkeler	202,656

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Grinding machine, A. Warth..... 202,899
Hammock, E. F. Hanks..... 202,814
Harness pad, J. T. Smith..... 202,879
Harrow, J. H. Barr..... 202,780
Harrow, R. M. Skinner..... 202,671
Harrow, G. Watt, Sr..... 202,903
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Indicator, J. Freeman..... 202,643
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Ironing table, F. M. Smith..... 202,877
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Lifting jack, O. V. Price..... 202,666
Log turner, Driscoll & Balcom..... 202,712
Logotype manufacture, G. W. Glazier..... 202,716
Loom picker, J. M. Parker (r)..... 8,191
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Mandrel, expanding, F. H. Vannam..... 202,768
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Moulded articles, composition for, W. H. Dibble.. 202,636
Motion, device for converting, A. G. Smyth..... 202,880
Motor, W. K. Azbill..... 202,626
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Nozzle, bellows, T. H. Bullock..... 202,700
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Nut lock, J. L. Hayward..... 202,723
Nut lock, A. Needs..... 202,859
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Pistol holster, W. N. Le Page..... 202,738
Pitchforks, making, H. B. Kinney..... 202,658
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Planter and fertilizer distributer, Smith & Boyle. 202,878
Planter, R. H. Ivy..... 202,625
Plow, G. S. Haven..... 202,817
Plow, J. Oldendorph, Jr..... 202,746
Plow, G. W. & W. F. Wimpee..... 202,688
Plow colter, J. Augspurger..... 202,624
Pocketbook clasp, L. Prahar..... 202,755
Press, copying, E. H. T. C. Rath..... 202,756
Press, hay and cotton, M. Lahaussois..... 202,835
Printers, roller composition for, A. Van Bibber.. 202,897
Printing apparatus, Hillen & Crockett..... 202,650
Printing machines, lapping for, Jillson & Smith.. 202,826
Pulley, loose, J. Saltar, Jr..... 202,667
Pulp grinding machine, J. W. Brightman..... 202,698
Pump, Lucasse & Newell..... 202,659
Pump, ammoniacal gas, J. Enright..... 202,641
Pump, chain, G. B. Valentine..... 202,896
Pump, cream, G. A. Baron..... 202,778
Pump, double-acting, C. Heister..... 202,725
Pump, double-acting, N. Clute..... 202,633
Pumping machine, A. H. Low..... 202,841
Rail, compound, C. Conrad..... 202,635
Railway switch, J. W. Close..... 202,632
Railway turn-table, locking, E. H. Johnston..... 202,828
Rake, horse hay, E. Knapp..... 202,833
Rake, horse hay, S. Ritty..... 202,871
Refrigerator, A. C. Rand..... 202,867
Roof battening, N. H. Brown..... 202,784
Roofing fabric, C. M. Warren..... 202,902
Satchel, A. McKinnon..... 202,850
Sawing machine, G. Schleicher..... 202,668
Scales, weighing, T. Fairbanks..... 202,800
Settee, folding, H. T., L. B. & F. F. Morse..... 202,856
Sewing machine, J. McCloskey..... 202,738
Sewing machine, Morrell & Parkinson..... 202,857
Sewing machine, broom, C. Palmer..... 202,749
Sewing machine, glove, C. M. Boland..... 202,695
Sewing machine presser foot, T. P. West..... 202,771
Sewing machine trimmer, J. E. Wilson..... 202,908
Sewing machine work trimmer, H. H. Hallett.... 202,721
Sifter, clay, N. Goddard..... 202,717
Skirt exhibitor, G. W. Everett..... 202,713
Sleeve supporter, J. P. Lindsay..... 202,735
Slimes, machine for drying, J. W. Dillon..... 202,709
Soap crutching machine, S. Strunz..... 202,886
Spark arrester, C. E. Wyman..... 202,914
Speculum, J. C. Hall..... 202,813
Spring, vehicle, W. Michael..... 202,851
Spring, vehicle, Muldoon & Davis..... 202,858
Stamp, hand, E. D. Chamberlain (r)..... 8,201
Stamp, postage, J. Sangster..... 202,760
Staple hook, N. Burnham..... 202,786
Starch, process of drying, T. Kingsford..... 202,832
Steam trap, J. Ryan..... 202,759
Steamer, feed, Darling, Parshall & Wendell..... 202,706
Stench trap, R. G. M. Nowell..... 202,860
Stilts, L. Bordewich..... 202,782
Stove back, portable, W. C. Barkalow..... 202,777
Stove bottom, G. S. Stannard..... 202,883
Stove, F. J. Gould..... 202,718
Straw cutter, G. R. Pierpont..... 202,751
Stretcher and wheeled frame, Rice & Childs..... 202,868
Surveying instrument, tripod head, A. Young..... 202,916
Swivel back, A. Wallaah..... 202,898
Telephone transmitter, G. B. Richmond..... 202,870
Thill coupling, E. R. Mason..... 202,846
Timber, preserving, W. Thilmany..... 202,678
Tobacco, treating, J. Trent..... 202,680
Tobacco stem crusher, N. H. Borgfeldt..... 202,696
Toy, S. Potts..... 202,754
Toy pistol, C. Mohr..... 202,742
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Trace coupling, J. Fourney..... 202,806
Transplanter and hoe, M. Wilson..... 202,909
Tread mill, R. A. Brown..... 202,783
Truck, car, Marsters & Fisher..... 202,737
Truck, car, C. Speidel..... 202,881
Truss, L. T. J. Lubin..... 202,842, 202,843
Umbrella tip cup, A. Dittrich..... 202,710
Valve, F. Brown..... 202,785
Valve for barrels, etc., J. Byrne..... 202,629
Vehicle, side spring, Milligan & Wood..... 202,741
Vehicle, side spring, W. L. Weston..... 202,904
Velocipede, H. F. Parsons..... 202,665
Ventilator for houses, J. E. Richard..... 202,869
Ventilator, louver, J. F. Starr, Jr..... 202,765
Vessel, compartment, J. Butcher..... 202,701
Wagon, dumping, J. H. Nelson..... 202,745
Wagon top, V. B. Grinnell..... 202,810
Washing machine, J. G. Beardsley..... 202,781
Washing machine, J. J. Straub..... 202,887
Washing machine, C. Thompson..... 202,889
Water closet, M. Hogan..... 202,652
Water closet, drip tray, C. Harrison (r)..... 8,189
Water meter, J. Johnson..... 202,827
Water raising apparatus, D. M. Smyth..... 202,764
Weather strip, D. S. Wood..... 202,912
Well boring and rock drilling, J. P. Summers..... 202,677
Wells, lining bored, J. Dollard..... 202,796
Wheels, scraper for vehicle, M. Robbins..... 202,872
Whiffletree hook, N. Hill..... 202,649
Whip rack, S. A. Darrach..... 202,794
Windmill, S. E. Jarvis..... 202,825
Wire rolling machine, Shaw & Spence..... 202,670
Wire rolling machine, guide for, W. W. McCallip. 202,848
Wire rope and cable, T. Hager..... 202,812
Wool, etc., separating, J. Y. Slater..... 202,672

TRADE MARKS.

Ague cures, M. C. White..... 5,933
Axes, Markley, Alling & Co..... 5,901
Bitters, Alphonse Walz..... 5,936
Boots and shoes, E. H. Stark & Co..... 5,905
Bread raising preparations, D. & L. Slade..... 5,934
Bronchial lozenges, C. F. Asche..... 5,898
Burning fluids, J. G. Gorrell..... 5,932
Caps for toy pistols, etc., E. H. Wander..... 5,915
Catarrh remedy, F. W. Wei De Meyer..... 5,943
Chemical products, Solvay & Co..... 5,946
Chemical solution for preserving dead bodies, Rodgers Allekton Company..... 5,933
Chewing and smoking tobacco, J. B. Pace..... 5,912
Chewing tobacco, J. W. & C. G. Holland..... 5,923
Cigars and tobacco, S. Jacoby & Co..... 5,944
Cigars and tobacco, Lichtenstein Bros. & Co..5,899, 5,900
Cigars, Theodore Schunemann..... 5,913
Cigars and tobacco, Joseph Loewenherz..... 5,926
Cigars, Celestino Palacio..... 5,930, 5,931
Collars, Pine, Adams & Dunham..... 5,929
Compressed yeast, Oscar King..... 5,910
Corsets and waists, J. G. Fitzpatrick..... 5,921
Cotton goods, J. Caswell & Co..... 5,893
Cotton yarn, L. G. Hansen..... 5,894
Cough mixture, Rhodes & Lewis..... 5,932
Door springs, Van Wagoner & Williams..... 5,942
Files, Western File Company..... 5,939, 5,940, 5,941
Italian paste, H. K. & F. B. Thurber & Co..... 5,907
Lace articles, George Cox..... 5,918
Liquid drier, A. W. Pratt & Co..... 5,928
Medicine, Powell & Turner..... 5,902
Medical compound, Dundas Dick..... 5,920
Medicinal preparation, C. W. Scott..... 5,935
Medical preparation, W. L. Keller..... 5,909
Ostrich feathers, etc., Welch & Creighton..... 5,914
Paper, Crane Brothers..... 5,919
Paper bags, Smith, Dixon & Co..... 5,897
Paper carpets, etc., T. S. Scott & Bro..... 5,904
Prepared calcimine, G. I. Stevens..... 5,906
Preparations of witch-hazel, Fred. Humphreys..... 5,925
Pile cure, S. J. Cox & Co..... 5,908
Scrap books, Slote, Woodman & Co..... 5,896
Screw cap for fruit jars, etc., The Con. Fruit Jar Co. 5,947
Sewing machines, Providence Tool Company..... 5,895
Shirts, C. H. Buck..... 5,917
Shirts, C. L. Smith..... 5,903
Smoking tobacco, Oliver & Robinson..... 5,927, 5,945
Smoking tobacco, B. F. Weyman..... 5,948
Steam engines, Armington & Sims..... 5,916
Toweling, Wilmerding, Biddle & Bisset..... 5,937
Whisky, A. & H. Myers..... 5,911
Worsted braid, A. C. Haynes..... 5,924

DESIGNS.

Advertising monuments, J. B. Turner..... 10,649
Cabinet jewelry, W. A. L. Miller..... 10,650
Glassware, T. B. Atterbury..... 10,643
Match safes, J. H. Davis..... 10,644
Packages, Samuel Kimberly..... 10,647
Pistol handles, Harrington & Richardson..... 10,646
Scarf pin, Henry Griffith..... 10,645
Jewel case, E. H. Zoepfel..... 10,651
Jewelry, Abraham Steinan, Jr..... 10,648

FOR THE WEEK ENDING APRIL 16, 1878.

TRADE MARKS.

Baking powder, Cleveland Brothers..... 5,875
Biscuits, E. J. Larrabee & Co..... 5,855, 5,856
Builders' hardware, Russell & Erwin..... 5,866
Cassimeres, Franklin Glazier..... 5,879
Chains, The Smith & Egge Manuf. Co..... 5,890
Cigars, G. Fehl & Co..... 5,862
Cigars, cigarettes, etc., Straiton & Storm..... 5,867
Cigars, D. E. Rose..... 5,886
Coffee, Coelho & Mohlfeld..... 5,861
Coffee, spices, etc., Weikel & Smith Spice Co..... 5,891
Coffees, spices, etc., Weikel & Smith Spice Co..... 5,869
Dental supplies, H. D. Justi..... 5,882
Essential oils, J. J. Quetting..... 5,865
Gloves, George Lisner..... 5,883
Leather, Ordway & Clark..... 5,864
Lounges, W. E. Buser..... 5,874
Medical compound, C. T. Swift..... 5,888
Mineral water, T. F. Goode..... 5,878
Organ mechanism or action, E. P. Carpenter..... 5,860
Paints, L. B. Stone..... 5,889
Pills, E. E. Barnum..... 5,873
Playing cards, V. E. Mauger..... 5,870
Ready mixed paints, Norton & Wieder..... 5,871
Ribbons, Meyer & Dickinson..... 5,863
Roasted and ground coffee, Fink, Brother & Co..... 5,877
Salt, H. K. & F. B. Thurber & Co..... 5,872
Saws and files, Emerson, Smith & Co..... 5,876
Smoking tobacco, B. Leidersdorf & Co..... 5,887
Smoking, etc., tobacco, Rowland & Newbrandt..... 5,884
Soap, B. T. Babbitt..... 5,857
Tea, J. R. Walsh..... 5,892
Tobacco and cigars, A. E. Irwin..... 5,881
Toys, J. A. Crandall..... 5,859
Wines and brandies, J. Calvet & Co..... 5,858
Woven cotton fabrics, Minot, Hooper & Co..... 5,885
Wrench, Girard Wrench Manuf. Co..... 5,880
Writing paper, Byron Weston..... 5,868

DESIGNS.

Badge, Henry Moesinger..... 10,629
Badge, R. O. Wood..... 10,636
Billiard table leg, H. W. Collender..... 10,637
Billiard table leg, H. H. Holly..... 10,638
Billiard table leg, Oscar Norman..... 10,639
Bracelet, J. A. Hedstrom..... 10,642
Burial caskets, W. J. Noble..... 10,630
Carpets, T. J. Stearns..... 10,633
Casket screw, Rogers & Huggins..... 10,631
Child's dress, John McNeven..... 10,634
Clock face, George Ager..... 10,625
Clock case, M. C. Jones..... 10,628
Crochet fabric, C. A. Burnham..... 10,626
Organ case, Samuel Hayward..... 10,635
Pendulum weight, George Hoyting..... 10,627
Sheet metal water pipe, J. F. Starr, Jr..... 10,632
Writing paper, M. H. Pirie..... 10,640, 10,641

English Patents Issued to Americans.

April 23 to May 9, inclusive.

Anti-friction bearings.—J. C. Thompson, Brooklyn, N.Y.
Balance.—F. Fairbanks, St. Johnsbury, Vt.
Boot and shoe lasting machine.—H. G. Thompson, Milford, Conn.
Carbureter feed regulator.—B. Chollar, Chicago, Ill.
Caster for furniture.—C. E. Parent, New York city.
Concrete.—J. S. Wethered, New York city
Firearm, repeating.—B. C. Gough, Canton, Miss.
Folding and printing machine.—C. Chambers, Jr., *et al.*, Philadelphia, Pa.
Grinding mill.—P. T. Elting, Boston, Mass.
Inspirator.—H. M. Whitney, Boston, Mass.
Lacing hooks.—E. Raynz, Boston, Mass.
Loom.—H. Woodman, Saco, Me.
Loom shuttle.—W. A. Doherty *et al.*, Fall River, Mass.
Loom shuttle.—J. M. Palmer *et al.*, Cambridge, Mass.
Motor.—C. Huebner *et al.*, Newark, N. J.
Pulley.—W. Webster, Washington, D. C.
Railway spring.—G. E. Gray, San Francisco, Cal.
Railway switch.—D. Tracy, Ridgewood, N. J.
Recording and reproducing sounds.—T. A. Edison, Menlo Park, N. J.
Refrigerator car.—W. D. Mann, Mobile, Ala.
Sea sickness, preventing.—J. C. Thompson, B'klyn, N.Y.
Sewing machine.—D. H. Campbell, Pawtucket, R. I.
Silicious compound.—J. W. Hyatt, Newark, N. J.
Slate for drawing.—C. C. Shepherd, Passaic, N. J.
Stone, artificial.—J. H. Thorp, New York city.
Sugar cutting machine.—W. Jasper *et al.*, San Francisco, Cal.
Tape measure.—A. F. Ward, Philadelphia, Pa.
Telephone.—J. F. Bailey, New York city.
Terra alba substitute.—C. T. Tomkins, New York city.
Watch balance.—C. v. d. Woerd, Waltham, Mass.
Wire rolling machine.—D Shaw *et al.*, Pittsburg, Pa.

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(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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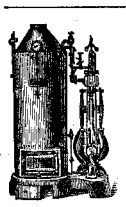

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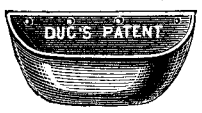

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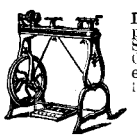

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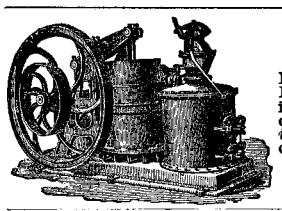

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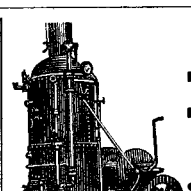

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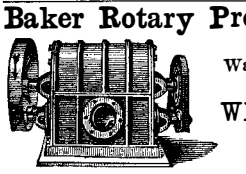

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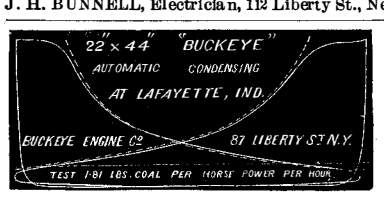
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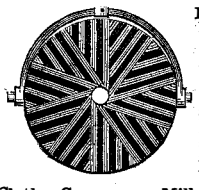

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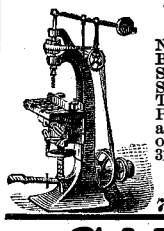

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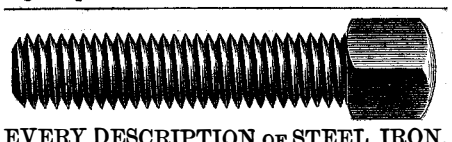

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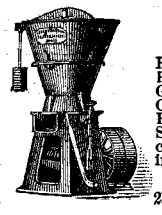

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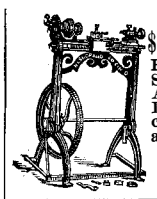

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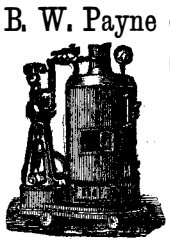

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